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Preparing a Wet Paddy Field near Madras with the Rotavator

VOLUME 5, No. 2 FEBRUARY 1953

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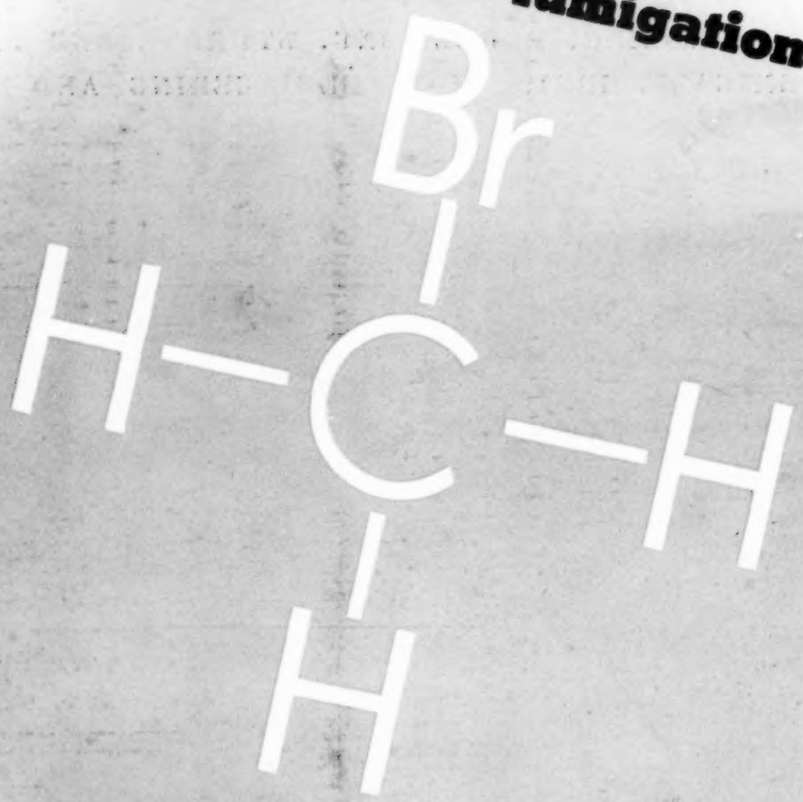

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WORLD CROPS

Editor: Sir Harold A. Tempany, C.M.G., C.B.E., D.SC., F.R.I.C.

Vol. 5, No. 2. FEBRUARY 1953

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Published monthly by Leonard Hill Limited, Stratford House, 9 Eden Street, London, N.W.1, England (Tel. Euston 5911)

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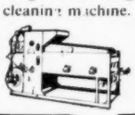

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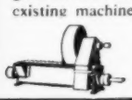

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Editorial Comment

Rice in 1953

IT is generally conceded in all well-informed quarters that the problem of future supplies of rice is the most serious aspect of the world's grain position. This has repeatedly been stressed in many quarters, and since WORLD CROPS first made its appearance we have frequently referred to the matter and endeavoured to present to our readers recent information on the manner in which the situation in this regard is developing.

The work of FAO has, during the past three years, been materially directed toward efforts to improve the position, and the most recent is the arrangements made for calling a meeting at Bangkok in January 1953 in which rice-importing and -exporting countries of the East and the West will participate.

The meeting is the continuation of and sequel to a number of meetings on the subject of rice production sponsored by FAO during previous years and has been called in view of the increasing gravity of the situation and the fact that, according to FAO calculations, an additional 1,300,000 tons of rice are needed each year to meet the demands of the annual population increases in the rice-eating countries.

It is not expected that this meeting can bring about any quick alleviation of the present rice shortage. The main object is to discuss and to attempt to clarify the international, economic and other factors which at present adversely affect the production and distribution of rice, and to try and reach some improved mutual understanding on long-term policies which will help to ensure the production and distribution of the great quantities of rice required in the vast regions where rice is the staple diet.

The value of the action of FAO in calling this meeting and high-lighting the critical nature of the rice situation is unquestionable. If only these efforts could receive the popular attention which they so richly deserve in all countries of the world, irrespective of whether or not they are countries of rice production and major consumption, it would indeed be a great step forward, for it is no exaggeration to say that on the solution of the problems of increasing rice production in step with increasing popular demands, the future peace of the world depends in appreciable measure.

A Colombo Plan subsidiary

LESS widely known than the Colombo Plan itself is its subsidiary, the Technical Cooperation Scheme. 'Subsidiary' is, perhaps, an inadequate term, for no amount of capital assistance for the countries of South and South-East Asia can bring effective and established development if technical experts are not also provided and training facilities made available for producing future technicians. The Technical Cooperation has its headquarters at Colombo; now two years old, this Bureau acts as a clearing-house for bringing together requests for technical help and offers from other countries. It is still too early to make a critical judgment on the scheme, but it is certainly fair to say that its initial record of achievement has been good and promises even better for the future. India has provided experts to Ceylon, some of them for agriculture, and offered fellowships at the Central Rice Research Institute at Cuttack. Pakistan has offered Ceylon scholarships in sugar agronomy and training facilities for a vegetable oil extraction project. However, mutual help from within Asia itself must inevitably be much smaller than that which flows from outside. In Pakistan an experimental livestock farm is being set up, with Canada, Australia, and New Zealand jointly providing equipment, cattle, and experts to manage the scheme in its early stages. In Ceylon Canada is providing experts, trawlers, and refrigeration plant to help the development of the fishing industry.

In the first 20 months of the Technical Cooperation Scheme 80 experts have been provided to Colombo Plan countries requesting such help; and training facilities for 658 persons in the Colombo Plan countries have been made available. In addition, senior officials, mainly from India and Pakistan, have been able to undertake missions to Australia, Canada and New Zealand. Britain's major contribution has been the supply of experts and the provision of training facilities. Not all this technical assistance is concerned with agriculture, of course, but a significant proportion undoubtedly is. India, Pakistan, and Ceylon are the three principal countries to benefit from the Technical Cooperation Scheme, but Malaya, North Borneo, Sarawak, Indonesia, Nepal, Singapore, Thailand, and the Philippines are also participating. What has been done so far, however, is less than the first act of the drama and indeed no more than a prologue of great promise. Let us hope that adverse factors and influences will not retard further progress in this bold and imaginative 'combined operation.'

Wheat Pact prospects

THIS month (January 1953) will have witnessed the resumption in Washington of the discussions by the International Wheat Council of the possibility of a renewal of the International Wheat Agreement of 1949. According to a review of the present position by Mr. Leslie A. Wheeler, issued by the International Federation of Agricultural Producers, the outlook for a renewal of the agreement, which, as the author points out, is the one factor making for stability in the world wheat picture, is the reverse of favourable. If it is not found possible to renew the agreement it seems inescapable that the world is likely to revert to the conditions of cut-throat competition for wheat supplies, with the difference that the competition on this occasion will no longer be between private traders but between governments.

As with other commodities, the difficulty is entirely due to inability to reconcile the price claims of producers with the ideas of the consuming countries; if agreement can be reached and a plan formulated which meets the ideas of all

the interested parties, there will be a new pact, but if exporters continue to insist on the figures mentioned at the earlier meeting held in the spring of 1952, while the importers continue to insist that the price range of the present agreement must be maintained, the agreement must lapse.

One complicating factor in the position is price flexibility. As Mr. Wheeler points out in his review, the views of governments in the producing countries are largely determined by those of the farmers and the farm organisations, and these in turn are determined by the cost of living in the countries. National price supports and price guarantees may not be enough to support full production and in importing countries they cannot protect against the effects of high world prices.

Another factor is the problem of purchasing power, which depends on foreign exchange and which applies to all export commodities, including wheat. The report holds out small hope of the reappearance of a free market for wheat. At present Government policies, which originated in the first place as the result of the exigencies of war-time conditions, are directed mainly towards attempting to provide more stable prices to producers, and in some cases to consumers, than can be obtained through free markets.

By the time these lines appear in print the issue of the forthcoming discussions will have made themselves clearer if they have not, in fact, reached finality. Let us hope that they may at least give some indication of the way in which a satisfactory compromise may be reached and the wheat agreement, which at present shines out as one of the few really substantial points of progress towards a better world order, like a good deed in a naughty world, may be saved from an untimely demise.

Milk per acre

BRITAIN'S milk production presents a thornier long-term problem than most people suppose. The steady loss of agricultural land for urban, industrial, or military developments—well described recently as a form of erosion—hits the dairy farms particularly severely. Many of the best dairy farms in Britain have grown up in the 'green belts' of towns and cities, and at one time it certainly was all the better for milk to be produced as near as possible to its ultimate centres of consumption. These swards of grazing land, however, now seem to have a particular allure for the urban planners. To those who know little about farming, grassland often appears to be relatively non-productive and in their eyes it is only arable land which is truly harnessed to food production! On the other hand, milk, more than ever before, has become today the nutritional corner-stone of Britain's diet. Let milk become scarce or higher in retail price and there will at once arise a much greater outcry than a similar event for any other foodstuff would cause. The direct consumption of milk in Britain today is so great that it leaves only the smallest margins available for making cheese, and indeed high *per capita* consumption of milk seems to be a permanently established factor in the British economy.

Hitherto most of our attention has been devoted to studying milk output in terms of annual gallonage per cow. Much less attention, certainly, has been given to the output of milk per acre. The Farm Economics Department of King's College, Newcastle-on-Tyne, has therefore performed a service of high value in conducting for five years (1947-52) a survey of 35 dairy farms to measure milk output per acre and to assess, where possible, the most influential factors. The full report, by D. H. Dinsdale and T. Winter, available from King's College, should be studied by all dairy farm technologists. The investigators have adopted a very reasonable formula for assessing what part of a farm's total acreage is used for feeding milk-producing cows, and have found that in the 35 cases examined 30 farms were using from $2\frac{1}{2}$ to $3\frac{1}{2}$ acres of land per cow. Nevertheless, no consistent relationship could be observed between the acres used and the milk yield per cow.

Cocoa production in the West Pacific

THE current threat to the cocoa industry as a consequence of the spread of diseases, and the fact that cocoa production is not, largely as a result, expanding commensurately with world demands, is causing increasing attention to be turned to the possibility of cocoa growing in other parts of the world where the disease problem is not so great.

Some time ago we published an article in WORLD CROPS in which were described the efforts in progress in Malaya to develop cocoa production. The latest region to come under scrutiny in this regard is the vast conglomeration of island territories in the South Pacific, sometimes termed Oceania, which includes large land masses like New Guinea, smaller but still sizeable island units like New Caledonia, Fiji and the Solomon Islands, and a vast concourse of widely scattered smaller islands, many of them coral atolls (low islands) and others of volcanic origin and mountainous (high islands), which appear to offer possibilities in this and other directions.

To assist in the development of these regions an international body has been set up under the auspices of the United Nations with the title of the South Pacific Commission, with headquarters on the French island of New Caledonia. The Commission is concerned with agriculture, health, education and other aspects of development and welfare in the islands.

Under the auspices of this body Mr. D. H. Urquhart, lately Director of Agriculture in the Gold Coast and at present attached to the staff of Messrs. Cadbury, the well-known firm of chocolate manufacturers, has recently paid a visit to this region in order to examine the possibilities.

From his reports it is clear that in many of them natural conditions are well adapted to cocoa production, and the opinion has been expressed that cocoa as an economic crop holds out a good deal of promise in territories where suitable conditions of soil and climate are to be found, such as Western Samoa, New Guinea, the New Hebrides, Fiji and the Solomon Islands. In some of these territories, notably Western Samoa, cocoa is already cultivated as a crop on a moderate scale with very encouraging results, yields being reported to be about four times larger than those obtained in Trinidad. In Mr. Urquhart's view, the prospects for cocoa in Samoa are very good. The main difficulty in many of these

territories is the lack of a suitable and adequate supply of labour for development. With this must be coupled the need for adequate technical services to cope with problems which are almost certain to arise if cocoa cultivation on a large scale is attempted.

Most of them have agricultural departments which in some territories are fairly well staffed; in others provision in this regard could with advantage be strengthened. The course of future developments will be awaited with interest.

The spread of Swollen Shoot

WHILE on the subject of cocoa growing, a paper read before the recent International Horticultural Congress by Mr. A. F. Posnette, who was himself responsible for the recognition of swollen shoot disease of cocoa in West Africa as a virus disease, usefully called attention to a popular misconception concerning the origin and spread of the disease in West Africa.

He pointed out that it is commonly supposed that the disease appeared quite suddenly in the Gold Coast about 1936 and that subsequently it spread like a forest fire. This misconception arose because the disease was already widespread in 1939, when it was first shown to be caused by a virus; later surveys showed the trouble was far more widespread and dangerous than had been at first supposed.

This false idea of recent sudden origin and very rapid spread also suggested that a change had occurred in the environment, either climatic or soil deterioration, and this was first considered to be the cause of, and subsequently a predisposing factor to, the rapid spread of the malady.

It has, however, subsequently been shown that the disease has a long history in cocoa. It is, moreover, highly probable that it has a much longer history in indigenous forest trees and almost certainly long antedates the introduction of cocoa into West Africa. As long ago as 1918 there are records of sizeable patches of cocoa dying out in the area of first infection, but it was not until many farms had been destroyed that the serious and epidemic nature of the malady achieved recognition in 1936, while a further interval of three years had to elapse before the cause of the disease was recognised.

Since then spread has been almost continuous. Attempts to control the disease have had some outstanding successes, both experimentally and in local applications, but large-scale attempts at control have failed for varying reasons, notably because in 1947-48 swollen shoot disease became, alas, a pawn in the game for self-government, a fact that we have had occasion to deplore more than once in these columns.

The point, however, which we wish to emphasise is that what had happened in West Africa may again occur elsewhere and beset attempts to establish cocoa in new tropical environments. Swollen shoot virus has been, it appears for long an unsuspected denizen of the West African jungle. It also seems likely that a similar virus has long existed in the forests of Trinidad. It is therefore well within the bounds of credence that similar viruses may lurk unknown and unsuspected in the jungles of other parts of the tropics to which cocoa is introduced and only manifest themselves once the crop is established.

It is clear that the main hope of survival of an infant cocoa industry is the immediate recognition of new disease symptoms when and if they appear. If the condition had been recognised in the Gold Coast when first the symptoms manifested themselves 30-odd years ago the present tragic situation could not have arisen. Instead, mainly owing to lack of adequate trained staff, it went by default; it was indeed another case of too little too late. It is for this if for no other reason that we have stressed in the preceding paragraph the importance of providing adequately trained technical staff before attempting to develop new cultivations in untried tropical environments.

Hemp and hashish

IN our December issue a comment appeared in these columns on fibre production in the U.S.A. in which reference was made to efforts to improve the quality of true hemp (*Cannabis sativa*) and the need for evolving plants with a low 'marihuana' content, adding that this appeared to need some clarification.

A scientific correspondent has pointed out that this is an allusion to the fact that the hemp plant (*Cannabis sativa*), when the inforescences are half ripe, produces resins which constitute the drug known as hashish, widely used as a narcotic and intoxicant in many eastern countries. When mixed with tobacco it is used to make the 'marihuana' or 'reefer' cigarettes which are peddled in night clubs in the United States and other countries and which have given rise to several major scandals.

Cannabis sativa as a source of fibre came into use in Europe in the middle ages but later than did flax; apparently it was introduced from Asia, those parts of Europe nearest to Asia having with certain countries become the chief sources of supply of hemp fibre. The fibre itself is a valuable one the finer qualities of which are used for making cloth and the coarser for canvas and ropes.

Actually the evil repute of the plant as an intoxicant has greatly militated against the development of its cultivation as a very useful source of fibre, and in many countries its cultivation is forbidden. Not only in the U.S.A. but also in some European lands the possibility of evolving types of *Cannabis* which can be cultivated as a source of fibre and which do not produce the narcotic resin is engaging attention and some work is in progress at a number of points. Actually both monoecious and dioecious forms of the plant exist, of which the former may be the more promising.

How far resin production is a genetic character does not appear to be clear at present, but on the basis of the breeding of alkaloid producing plants there seems at least to be some chance that breeding and selection to produce strains of hemp which do not produce these resins might be successful. On the other hand the factor of climate must not be overlooked and there is general evidence which suggests that resin production is favoured by a hot dry climate.

Actually hashish production today is mainly confined to Asia Minor and the North African coast, and as one proceeds north to the European countries where the plant is cultivated for fibre production the narcotic content falls.

The agricultural journalist

IN our issue for December last we had occasion to comment in these columns on the particularly favourable position in which agriculture finds itself in relation to the Press. As we then remarked, agricultural science can claim one blessing in that it has never been seriously neglected by the Press, a notable reflection of which is the vigorous existence of the Guild of Agricultural Journalists.

The position in this regard and some of its implications was emphasised recently by Mr. G. R. Nugent, M.P., Parliamentary Secretary to the British Ministry of Agriculture, in a speech at a recent luncheon given by the Guild. Mr. Nugent was at pains to point out that in Britain, at any rate, agricultural policy is generally not a politically controversial matter, inasmuch as, in order to get results, continuity of agricultural policy is essential. One result of this, however, may be that in a predominantly urban community like the British the fact that agricultural matters remain largely outside the sphere of political controversy automatically reduces their news value and lowers public interest.

This is undoubtedly a drawback, but in the present condition of affairs and with the unfortunate tendency to attach major importance to news items which have direct sensational appeal it is hard to see where the remedy lies. To the average newspaper reader it is perhaps natural to pay more attention to the apparent present threat to life and property as the result of the crime wave which is alleged to be spreading over the country than to the much greater and graver threat which has arisen as the result of growing populations and shortening food supplies. It is also perhaps natural that at times wavelets of popular indignation and sympathy should arise over, for example, cases of compulsory dispossession of farmers who have failed to maintain on their holdings the minimum degree of good husbandry called for under the Agriculture Act of 1947, regardless of the fact that improper use of land may be in the existing conditions of shortage of foodstuffs and agricultural raw materials as great a threat to the well-being of the community as is, for instance, the unlawful possession of weapons of offence. In the circumstances, greater popular understanding of the conditions of the country's agriculture on the part of the British public is urgently needed. In Britain, probably more than in any other country in the world, the habit of regarding the production of manufactured goods as the only possible method of subsistence has become part of the ordinary townsman's philosophy, the corollary being perhaps the unspoken but tenaciously held belief that it is a bounden duty of other countries to continue to buy British goods and in exchange to supply the nation with all the food it requires on favourable terms. That this view is no longer, under existing conditions, tenable is becoming disastrously apparent; other countries are unfortunately evincing, from the British point of view, deplorable tendencies not to buy British and to produce manufactured goods for their own consumption so far as possible. Until the world achieves, as it must undoubtedly in the end achieve if it is not to perish, a system of overall control of production by which each particular area produces that which it can best produce, coupled with a system of exchange and a monetary policy which enables free interchange of goods and raw materials on a basis of fairly equated domestic prices, agricultural matters must continue to be matters of primary concern to the entire population of every country, Britain included.

We can only agree with Mr. Nugent, therefore, when he urges that agricultural journalism should use the great influence which it undoubtedly possesses to help to ensure that the climate of public opinion develops in a realistic way which will be the best insurance that the food supply and the life of the nation is adequately maintained in the future.

Elementary confusion

THOSE who—often enough long ago—first discovered and named the elements had little idea that they were undertaking a responsibility greater than that of proud parents deciding upon names before a christening. A well-known British company specialising in mineralised feeding-stuffs and other agricultural materials stated recently: ' Over 90% of the farmers who write to us about *manganese* in fact mean *magnesium*. This has now emerged so often that we make it a routine to check the point by correspondence when there is the slightest possibility of doubt.' It is most unfortunate that these two elements, increasingly recognised nowadays for their influence upon both plant and animal nutrition, should bear such closely similar names. Even their chemical symbols, *Mn* and *Mg*, offer little escape from the risk of confusion. Indeed, were we to attempt this path of clarification by publicising the two symbolic names in technical and trade literature, we should merely be building triple trouble for the future because another element—molybdenum—is fast achieving agricultural eminence, and while its name is distinctive enough its chemical symbol, *Mo*, would not be. It would be easy enough to rename these elements to suit the farming community now learning about them for the first time, but such changes would never achieve acceptance outside the agricultural world; risks of much greater confusion would be involved for the supply of manganese or magnesium salts must always come from chemical industry where the existent names are ancient and established coinage.

For plant nutrition the magnesium-supplying materials are usually magnesium-based lime or Epsom Salts (magnesium sulphate); and here magnesium, unlike manganese, is a major rather than a trace element. Manganese sulphate is the usual manganese-supplier for plants and it might help farmers if they remember that there is no ' popular ' name like Epsom Salts for this chemical. Indeed, there is something to be said for developing the agricultural use of the Epsom name for it certainly would obviate the risk of telephonic or calligraphic errors that mistake magnesium sulphate for manganese sulphate. In animal feeding the functions of the two elements are very different; both are needed in general nutrition but quite different amounts are required to cure deficiency diseases. Magnesium shortage causes lactation tetany, a kind of anaemia called hypomagnesaemia, and Hereford's disease; manganese shortage causes perosis in poultry and infertility in cattle. Accordingly farmers and merchants should be meticulously careful with their orders whenever either of these elements is involved.

Kenaf in Mauritius

SERGE STAUB, A.R.T.C., A.M.I.Mech.E. and E. LIMFAT

Department of Agriculture, Mauritius

The shortage of jute has attracted attention to jute substitutes as a source of fibre for making bags. Nowhere is this shortage more felt than in the sugar industry, and this has prompted experiments with jute substitutes in many places to fill the gap. In Mauritius, with its considerable sugar industry, Aloe fibre has been used for some years as a jute substitute for the making of bags, and experiments have recently been undertaken there in the cultivation of Kenaf for the same purpose.

WITH the shortage of imported jute from India since 1947, the sugar industry in Mauritius has been faced with a serious bagging problem. Efforts were therefore made to increase the local production of fibre by expanding the cultivation of the locally grown 'Aloe' plant (*Furcraea gigantea*), by improving the process of fibre extraction and by the introduction of substitute fibrous plants.

Following the encouraging reports on the cultivation of Kenaf (*Hibiscus cannibinus*) in Cuba, the U.S.A., Nigeria and South Africa, the Department of Agriculture introduced the plant from Nigeria where its exploitation is reported to be expanding rapidly.

Kenaf is a fast growing plant which seems to originate from Africa where it is found growing wild throughout the continent. It has, however, been cultivated as a substitute for jute in India, Korea and Russia with relatively little success owing to the primitive growing and retting methods used by the peasants. But with the application of more modern and mechanised methods in Cuba, South Africa and Nigeria, it may well be that Kenaf with its stronger and more durable fibre will prove itself to be more economic to produce than jute.

Cultivation

Perhaps the greatest advantage of Kenaf over the Mauritius 'Aloes' plant is its rapid growing and maturing qualities. Whereas the 'Aloe' leaves must be three years old before fibre extraction is practicable, Kenaf is ready for harvesting 130 to 150 days after planting. The product is a fine, white lustrous fibre longer and softer than 'Aloe' fibre. Further, the plant is tough and not exacting in its environmental requirements, and cultivation and harvesting can be mechanised to a large extent.

In the Mauritius experiments the seeds were planted in the first week of December in rows of 3 ft. and 18 in. apart with 15 to 20 plants per ft. within the row. The soil was treated with 500 lb. of 4-8-12 fertiliser per acre.

Kenaf plant ready for harvesting. Flowers and buds are clearly shown

Germination started a few days after sowing but a severe drought followed and about 50% of the young plants died. However, as soon as the rains came the remaining plants thrived rapidly, reaching a height of 4 to 5 ft. in two months. Some insects (*Cratopus*) were observed to feed on the leaves, but that did not seem to affect the growth and health of the plant. The soil between the rows was strikingly free from weeds and grasses, whereas the land surrounding the field was soon completely invaded.

The first flowers appeared during the last week of March and the lower seed capsules began to mature five to six weeks afterwards. As this is known to be the optimum time for harvesting, the plants were cut by hand during the first two weeks of April, and the fibre extracted by decortication or retting. The plants had then attained a height of 7 to 12 ft. and the stem diameter was ½ to 1 in. The plots with 3 ft. inter-rows yielded 10% less than those with 18 in. inter-rows, but the stalks were slightly taller and bigger. In general a yield of 10 tons of green plant per acre was obtained.

Fibre extraction

Whereas the 'Aloe' fibre belongs to the group of long vegetable fibres known as hard or leaf fibres, like sisal, istle and Manilla hemp, Kenaf belongs to the group known as soft stem or bast fibres like jute, flax and ramie. The fibre in Kenaf occurs in the bark and it is known to consist of an outer primary and coarse fibre and an inner secondary soft fibre. The fibre is freed from its pulpy tissue mechanically by scutching in a decorticator or biochemically by retting.

Retting

This process is accomplished by immersing the cut stalks in water until mild fermentation sets in. The gummy matter is decomposed, setting free the individual fibre strands. Retting can be done either in stagnant or running water and the duration lasts from two to four weeks depending on the temperature and quality of the water used.

In stagnant water retting, the stalks were spread out at the bottom of rectangular concrete ponds and weighted from above with iron bars. Water was added until all stalks were completely covered and left to ret in the open.

In running water retting, the stalks were tied into bundles and weighted in such a way that they were completely immersed in the stream but not touching the bottom.

When the bark, together with the fibre, slipped easily from the central woody core, retting was considered complete and the stripping process begun. This stage is important as over-retting results in weak and lustreless fibres. Stripping was done by peeling off the bark and fibre with the hands and then rubbing the strippings in running water until the fibre strands became freed from all tissues. The fibres were hung on lines and left to dry.

Although retting in running water is not so fast as in stagnant water, the fibre obtained was slightly superior in quality and appearance. Further, retting in stagnant water gave off such a repulsive smell that it may well be the stumbling block as far as labour is concerned.

Stalks which were cut and left to dry in the field for two months showed no difference in the quality of fibre obtained, showing that although harvesting time is critical, the stalks can be retted at leisure.

Retting yielded an average of 4 kg. of dry clean fibre per 100 kg. of green stalks.

Decortication

In Mauritius the fibre industry makes use chiefly of three types of decorticators, namely, the Raspador, the Souchon decorticator and the Humbert decorticator. In studying the fibre extraction of Kenaf these machines were all tried and it may be useful therefore to give here some particulars about them.

The Raspador — The hand-fed Raspador is the machine which until recently was the standard decorticator in Mauritius. It consists of a steel drum on which 20 angle iron blades, 2 in. by 2 in., are mounted longitudinally. These co-act with a fixed scraper plate. The diameter of the Raspador is 24in. from tip of blade to tip of blade, and its speed rotation about 1,000 r.p.m. When the machine is operated on 'Aloe' fibre leaves these are scraped first by the butt end and then by the tip end. The machine offers several disadvantages. Specialised labour is required for its operation and frequent adjustments of the scraper plate are necessary. The amount of residue left on the fibre after scraping is great and therefore retting has to be resorted to. In order to obtain satisfactory decortication the scraper plate has to be set close to the blades and thus a certain proportion of the fibres are damaged. The popularity of the Raspador is due to its relatively low initial cost.

The Souchon Decorticator — This machine is built on the same basic principles as the Raspador but includes several improvements. There is an automatic feeding device consisting of two chain-driven feed rollers. There is no withdrawing motion during the process of scraping. The upper roller is fixed to the decorticator cover which is articulated and is thus submitted to a practically constant vertical load, independent of the lift of the roller. The design also includes a special scraper plate when the machine is operated on 'Aloe' fibre leaves. These are fed by the tip end and after passing through the machine they fall on an endless rope which conveys them to a small conical

(*Left*) **Kenaf stalks being harvested. Note height of plant and distance between rows** (*Right*) **Hand raspadors; until recently the standard decorticators in Mauritius**

Raspador where the butt ends are decorticated. The recovery of the fibre is satisfactory but, as in the case of the Raspador, retting has to be resorted to. A certain proportion of the fibres are damaged when passing between the blades and the scraper plate and frequent adjustments to the machine are necessary. However, the capacity of the machine is much higher than that of the Raspador and the strenuous and specialised operation of hand scraping is eliminated. The machine offers attractive possibilities when a relatively high capacity of production is aimed at and maximum strength of fibre is of secondary importance.

The Humbert Decorticator — This consists of three steel discs 4 ft. diam. on which are mounted, radially, angle irons, 4 in. by 4 in., and distance pieces between the co-acting angle irons. In this case, windage, instead of blowing the fibre away from the machine as is the case with the Raspador, sucks it in and thus scraping is effected between the co-acting angle irons and the distant pieces. Scraping is very effective and retting unnecessary. As there is no hammering effect the fibre is not damaged. The design is simple, the construction sturdy and the machine once set can be made to work for months with-

KENAF FIBRE EXTRACTION

Decorticator employed	Retting method used	Weight of plant treated Kgm.	Weight of dry fibre produced Gm.	Recovery of fibre % green plant	Recovery of fibre % fibre in plant
Raspador	12 days in pond after decortication	70	1,450	2.1	52.5
Souchon	Do.	60	1,150	1.9	47.5
Humbert	Do.	62	440	0.7	17.5
	Green stalks in pond for 18 days	76	3,125	4.0	100.0
	Green stalks crushed and retted in pond for 16 days	50	2,000	4.0	100.0
	Dried in shed for two weeks and retted in pond for 18 days	75	3,115	4.0	100.0
	Dried in field for two months and retted in pond for 18 days ..	80	3,120	3.9	97.5
	Retted in running water for 21 days	73	2,725	3.8	95.0

out effecting any adjustment to the settings; however, the loss of fibre in the residue, specially of the short fibres, is high and that constitutes a serious disadvantage.

Owing to the large bulk of the leaves, the Kenaf stalks were decorticated top end first so that the lower stem could be used to force the leaves into the machine. The lower part of the stem was then decorticated. The fibre obtained from the Raspador and Souchon decorticator differed very little. Scraping was far from complete with long strips of the bark untouched and a considerable amount of the woody core and leaves were still adhering to the fibre; thus retting was necessary. The Humbert machine yielded a much cleaner fibre but scraping was so harsh that a high percentage of the fibre was lost in the leaves and core.

Humbert decorticator and automatic feeding device

Discussion

A very dry region was selected for the experiment as it is in such regions only that fibre can compete with sugar under the present economic conditions, but it is perhaps unfortunate that the sowing of the seeds was followed by an exceptionally dry period. This may account for the low fibre yield of 4% compared with 8% reported elsewhere, as drought during the growing period is known to retard fibre formation. Rainfall during the first month of growth was 0.1 in. and 3 in. during the second month. However, the seeds having been imported from Nigeria, it is believed that a higher fibre content may be obtained in future following acclimatisation and with selected strains.

The scraping machines available locally appear to be unsuitable for the decortication of Kenaf. These decorticators are designed to deal with the local leaf fibre of the Furcraea which is of a different class from the stem fibre of the Kenaf and, as a result, the highest percentage recovery of fibre obtained by decortication was only 50%. It would be useful to ascertain what are the results obtainable with flax scutching or jute softening machinery.

As harvesting time is critical and an important factor in both the qualitative and quantitative production of fibre, retting offers far better prospects than decortication as the process can be spread out over a period of several weeks when the dried stalks will yield a practically unaffected fibre. This is not possible with mechanical decortication as considerable fibre wastage occurs on treating a dry stalk and the only solution would be the use of a large number of decorticators and labour for only a short time during the year.

The cultivation of Kenaf fits in well with the agricultural economy of the Island as nearly all the stages of fibre production occur during the inter sugar crop period when labour is relatively abundant. Further, the possibility of planting it on the border of cane fields and thus using it as a barrier against invasion of the field by grasses and weeds, coupled with its fast and luxuriant growth, makes the cultivation of Kenaf in Mauritius worthy of thorough investigation.

Retting ponds. Stalks are spread out at the bottom of the ponds and weighted from above with iron bars

RAINFALL AT THE TOBACCO RESEARCH STATION RICHELIEU

AVERAGES, 1939 TO 1950

	In.
January	4.30
February	5.70
March	6.14
April	3.96
May	1.35
June	1.08
July	1.11
August	0.47
September	0.70
October	0.60
November	1.78
December	4.31
Year Average ..	31.48

1951 TO 1952

	In.	No. of Rainy Days
1951		
November	0.78	4
December	0.11	1
1952		
January	7.00	13
February	7.30	13
March	9.28	11
April	1.38	7
May	0.65	10

Congo Jute and its Potentialities

A Third Jute Substitute

A. E. HAARER, F.L.S.

In two previous articles on jute substitutes the author has reviewed the production of Kenaf (Hibiscus cannabinus) and Roselle (Hibiscus sabdariffa L). In the following paper Mr. Haarer discusses the third of the possible jute substitutes, Urena lobata. The information in this article is contained in part in the author's recent book on the subject, reviewed in WORLD CROPS *two months ago.*

THE plant that is the least regarded as a potential jute substitute by American and British interests is *Urena lobata* L., known in the fibre trade as Congo Jute, Aramina fibre, or Paka. This is all the more curious because the fibre is known to resemble jute in all its qualities more closely than any other. Only in one country, the Belgian Congo, has it been grown economically on a large scale, though the French at Niari in French Equatorial Africa began a pilot scheme to discover the best way to cultivate the crop and extract the fibre by mechanised means, and reached a production of 1,200 tons in 1951. Sowings have also been made on a plantation scale in the Sabi Valley of Southern Rhodesia where the crop is said to have given good yields of excellent fibre.

Kenaf, the favourite jute substitute, has been taken to many of the warmer parts of the world by human agency; the edible variety of Roselle is also found in most tropical countries and has hitherto been cultivated mainly for the sake of its edible calyces. *Urena lobata* has spread, however, far more thoroughly into almost every corner of the tropics and even into many temperate regions by natural means.

Occurrence and properties

The plant occurs as a weed in cultivated fields, even in countries such as Florida and Cuba where Kenaf is now being cultivated. In Madagascar, Trinidad and parts of Brazil the wild growths are so extensive and thick that they have either been exploited for fibre extraction, or plans have been made to use them for this purpose. Why, then, has the plant not been developed as the most important jute substitute, transcending as it does both Kenaf and Roselle in the special qualities of its fibre ? [1] [2]

Comparative analysis shows that it has the same fineness, softness and lustre as jute, and since it is more flexible than its competitors it has better spinning qualities.

This is brought out in the Table in which the chemical analysis of Urena from various sources is compared with data for true jute.

CHEMICAL ANALYSES OF URENA AND TRUE JUTE FIBRES

Percentage of	Congo Jute					True Jute	
	Brazil	Gambia	Northern Rhodesia	India 1	India 2	Calcutta	Extra Fine
Moisture	9.3	10.9	10.8	9.9	10.6	12.0	9.6
Ash	0.7	0.4	0.8	2.4	0.3	1.0	0.7
α-Hydrolysis loss ..	10.2	9.8	8.5	12.2	9.4	9.2	9.1
β-Hydrolysis loss ..	18.2	16.3	11.8	16.3	13.4	14.3	13.1
Acid Purification Loss	1.9	1.3	1.0	3.0	1.1	2.6	2.0
Cellulose	76.0	74.6	80.5	73.5	77.5	76.4	77.7

Data extracted from various Bulletins of the Imperial Institute.

Properties of the fibre

If Congo jute is woven by itself it is said by Dundee experts to produce a fabric which is superior to a similar fabric made entirely of Kenaf, though it is not quite equal to that made from 100% true jute. The comparison in this case should be fair, since all the fibres tested apparently originated from peasant cultivators, and were thus produced in the raw state in much the same way. It has been said that a small excess of surface fibre develops while spinning on account of the inferior flexibility to jute, but the flexibility of Kenaf and Roselle is much less. The dimensions of the ultimate fibres are about the same.

Characteristics of the plant

Urena lobata is a member of the order *Malvaceae*. It is often regarded as an annual, but it can become perennial in warm and humid climates. Unlike Kenaf or Roselle it varies to an extraordinary extent in its growth, foliage, and the colour of its flowers in every locality where it is found growing; no breeding or selection work has been done on it except in the Belgian Congo, where it has been carried out on very broad lines. Extreme care is not given, it is said, because the authorities know that the native cultivators are irresponsible, and that wild plants occur everywhere in and near the cultivated plots as volunteer growths. It is not easy to keep an issue of seed pure under these circumstances for longer than a season or two. [3]

During the last three years there have been rumours that the cultivation of *Urena lobata* is to be curtailed in the Belgian Congo in favour of another fibre crop. These rumours are unfounded and arose from a misunderstanding of the Belgian aims.

Firstly it was found that any considerable increase in cultivating *Urena lobata* might affect the food supply of the African growers, since all the processes involved in the production of the fibre took up too much of the peasant farmer's time. Secondly, the medical authorities queried the advisability of allowing so many retting pools containing stagnant water in and around the villages. Preliminary investigations were carried out to see what might be done to instal central retteries under stricter sanitary control, and to mechanise the industry as much as possible to save the amount of hand labour used. The first report was much too pessimistic because it envisaged difficulties concerning the transport of stalk. The writer was not apparently aware that bark-stripping machinery could be installed. [4] [5]

Varieties and uses

A variety known as *Urena lobata* var *sinuata* is preferred by Africans in Northern Nigeria, where it is used to extract fibre to make string and fishing lines. It is said to have a taller and less branched growth, and the leaf is somewhat more distinct than other types, though there appears insufficient proof to call this a definite variety of *U. lobata* on the one hand, or to list some of the material emanating from Asia as a separate species under the name *U. sinuata*.

In one character all the varying forms of *U. lobata* agree, but differ widely from Kenaf and Roselle. Instead of the seed capsules splitting open, and having smooth loose seeds within, which are liable to shatter during harvest, the capsules of *U. lobata* are formed of five small carpels each containing a single seed. The carpels fall apart when they are ripe, and because the outer portion of the husks are covered with short hooked bristles, they agglomerate together and are difficult to separate for sowing.

The hooked bristles have obviously assisted the widespread distribution of the plant, and are one of the factors responsible for the absence of enthusiasm regarding the cultivation of Congo jute on a large scale by mechanical means. The seeds do not shatter during harvest, but it is wellnigh impossible to hull them free from the carpels by mechanical means without damage to the seed. The carpels themselves must be sown, and the hooked bristles rubbed off by hand, scarified by machine, or dissolved by acid before they can be sown by a mechanical drill.

There are several other species of *Urena*, but only one that might be of use. *Urena repanda* Roxb. has smooth carpels, but no attempt has been made by specific crossing to transfer this character to *U. lobata*, nor has the plant been examined properly regarding its fibre content. During preliminary selection work in the Congo the Belgians have easily separated out some of the better forms of *U. lobata* for early maturity, drought resistance, and higher yield. In view of the fact that the plant is so widespread in its various forms in both tropical and temperate regions, it is surprising that so little selection or breeding work has been done.

Yields

Tests of yields and of sowing rates have never supplied enough information, nor have they been carried out on a proper scale or in a proper way. Alleged yield figures from the Congo may be discounted because they are devised from broadcast sowing and native cultivation.

A test made in Alabama to study the possible utilisation of jute substitutes as commercial sources of fibre in time of national emergency gave the maximum yields of mill-run fibre produced under experimental conditions as follows:—

Species	Yield in lb. of fibre per acre
Hibiscus cannabinus (Kenaf)	3,103
H. Sabdariffa var *altissima* (Roselle)	2,791
Urena lobata (Congo jute):	
Sowing rate, 25 lb. per acre	1,482
Sowing rate, 50 lb. per acre	2,016

It has already been suggested that this test may not be an entirely fair comparison, inasmuch as it is hard to see[6] how the merits of a crop can be judged from one test in one locality where conditions may not be suitable.

A later test, involving seed rates and yield, carried out in Cuba was also by no means conclusive.[7] Five acres were sown in all, but *only three square yards were harvested* from each of six plots. The seed was sown broadcast and by hand at different rates on five of the plots, and in 8 by 6 in. drill rows on the sixth plot without scarifying the seed.

Very little variation was shown in the plant stand, irrespective of seed rates, and the only treatment in which the theoretical plant population equalled the actual stand was in the plot sown 8 by 6 in. apart. Since the seed carpels are small and light, only 5 to 6 lb. should have been necessary to sow at this planting distance, but on account of the difficulty of separating the carpels, approximately 25 lb. of seed were actually used.

In the particular locality in which the test was made it seemed that only 30 plants per sq. yd. could be supported on the soil, and for this reason the other seedlings may have died. Yields per acre, which had to be computed from only 3 sq. yd., showed row planting to be superior to broadcast sowings, even when the seed rate was as high as 40 lb. Moreover, the yield in comparision with Kenaf of an age appropriate for harvest did not appear to be much less. The conclusion was that Congo jute was capable of producing satisfactory yields of fibre on fertile soils with suitable climatic conditions, but that Kenaf was preferable on soils of poorer quality.

General

The Belgians have selected strains of Urena which do well on the drier savanna soils, and others which do well on rich forest soils, but before a test of their relative values could be considered conclusive, selections of types must be made from the many that occur in a wild state. Moreover, the tests should be carried out in more than one environment, with varying times of sowing and spacing trials superimposed.

Several reports indicate that germination of seed of *Urena* may be irregular, or that the seedlings in the cotyledon stage are somewhat hesitant in establishing themselves before they start rapid growth. These questions also need investigation. The seed is generally sown in the husk of the carpel and this might have some retarding influence on growth.

Once seedlings are established and begin to grow they progress at a sufficiently rapid rate to overshade the soil and inhibit weed growth. When mature the stems are as tall as Kenaf when the right strain is grown in the appropriate environment, and the yield and quality of the fibre is at its best when the first flowers have opened. It appears that mechanical harvesting and mechanical bark-stripping and decortication could be carried out, though, on account of the extra fineness of the fibre it would probably be wise to ret bark ribbons and use mechanical aids to save transport and handling.

Conclusion

An attempt has been made in the foregoing to show that Congo jute is nearer in quality and performance to true jute than any other of the substitutes. Wild material is already established in many tropical countries. Selection work on wild material has not yet been carried out on a sufficient scale to demonstrate the possibilities, but there seems to be every indication that strains could be developed for different soils and climatic zones which would give yields comparable with Kenaf.

The mechanised cultivation and harvesting of Congo jute has not been widely studied hitherto. Questions concerning seed rates and spacing have also only received the scantiest attention. In general, the crop has not been subjected to sufficient research, but its potentialities seem considerable, and no schemes for research or trials in connection with the production of jute substitutes should exclude Congo jute.

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Agriculture in Taiwan

W. G. CASS

Taiwan or Formosa, a large island off the south-east coast of China, is the only part of China which has not come under Communist domination. In view of the importance to the peace of the world of conditions in South-East Asia, the following account of the agricultural situation therein is of interest. Under the present regime and with the assistance of JCRR, the joint Sino-American Commission for Rural Reconstruction, strenuous efforts are in progress to rehabilitate the island's agriculture and to enable recovery from the long period of exploitation by the Japanese which prevailed before the last war.

TAIWAN (the Chinese name of Formosa) has an area of about 15,000 square miles, or half the size of Ireland; of this only a quarter is cultivated land. Nevertheless, in many ways it is a country of profound interest; it epitomises the general problem of maintaining adequate food supplies against the need of a growing population, despite the fact that it has still large surpluses for export, while it illustrates many aspects of farming economics now closely engaging the attention of agricultural economists throughout the world. In particular the work of the Sino-American Joint Commission on Rural Reconstruction (JCRR) in this beautiful island appears to be meeting with considerable success and should be more widely known, since it is probably typical of much that is being done or could be done in other parts of the world.

Taiwan was for many years before the war under Japanese control, who did much to develop its agricultural resources, chiefly rice, sugar and sweet potatoes, large surpluses of which were sent to Japan. It has now been restored to China and exists more or less under war conditions with an army of occupation of about 600,000, which has to be fed. The Chinese Provincial Government of Taiwan has a progressive Department of Agriculture and Forestry, which publishes an annual year book. JCRR and the Provincial Government are directed to increasing yields by using improved seeds and varieties, better irrigation and (especially) larger supplies of chemical fertiliser. To some extent also attempts are being made to extend the limited area available for cultivation, through reclamation in various ways; a further aim is to stimulate the cultivation of sweet potatoes rather than rice, for the former are believed to be capable of giving larger food yields per hectare for the expenditure of less labour.

This map of Taiwan (Formosa) shows the principal cities, roads and railways

Physical characteristics

Climate. The island is mountainous, the highest peaks being over 12,000 ft. high. The climate is fully tropical, but is nevertheless agreeable and healthy. Rainfall is generally heavy and winds and storms are frequent. It is to the heavy rainfall that the island owes its typically evergreen appearance and its suitability for cultivating crops. The island lies directly in the course of the tropical cyclonic typhoons which traverse the China Sea at certain seasons of the year and which, when they strike Taiwan, may occasion widespread destruction and damage.

Soils. The soils may be classified into three main groups, *viz*., zonal, intrazonal and azonal. The first are mature soils formed under the influence of climate. They include mountain stony soils, podzols, yellow and red earths, mostly in hilly and mountainous regions of little agricultural importance, except in some cases with adequate supplies of fertilisers, when rice, tea, citrus fruits, bananas and pineapples—especially on the red and yellow soils—can be grown. Intrazonal soils have developed under local conditions and many are saline; some are used as salt gardens, others are adapted for rice or fish culture. Azonal soils are immature new deposits of varied origin. They are subdivided into marine-deposited or planosol type soils, sandstone and shale alluvials, slate and schist alluvials. The first are used mainly for sugar cane and, if irrigated, for rice. They are heavy textured and slightly acidic to alkaline. The sandstone and shale alluvials comprise the major part of the cultivated area, with rice and sugar cane as main crops. The slate alluvials are dark, have high calcium content and are mostly neutral. They are the most fertile in Taiwan. The schist alluvials in the eastern parts are high in lime and alkaline in reaction; the principal crops grown on them are rice, sugar cane and peanuts. Owing to easy leaching of nutrients and heavy cropping throughout the year, the soils require maximum fertilising. This is done with chemical fertilisers, green manure crops and compost. Apparently little farmyard manure is available and what there is goes mostly into the compost houses, of which there are about 360,000 yielding 8,000,000 tons per annum.

Fertilisers and irrigation

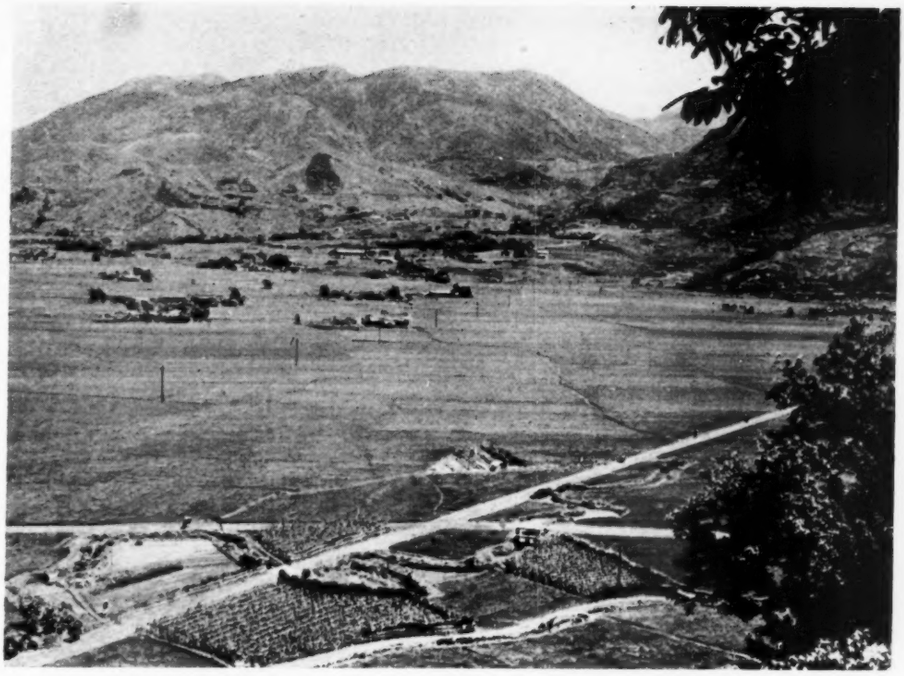
Fertilisers and water are the chief factors essential for increased production. The Provincial Government and the ECA China Mission purchased 231,934 tons of chemical fertiliser for rice in 1950 and about 280,000 tons in 1951.

The total used for all crops in 1951 was 372,877 tons; the crops included rice, sugar cane, sweet potato, wheat, jute, pineapples, tobacco, tea, citrus fruits and citronella. Compost production has been increased by repairing compost houses and encouraging pig raising. The number of pigs in Taiwan was in 1951 estimated at 1,500,000.

The JCRR, in co-operation with the Department of Agriculture and the farmers' association, by vaccination and other means helps to maintain the animals in good health, while Berkshires have been imported for the production of marketable

hybrids. A similar programme of improvement is being undertaken with cattle, water buffaloes and poultry. The JCRR and Government are also encouraging the practice of green manuring by provision of suitable seed and judicious use of lime. The Government has built six chemical fertiliser plants and with ECA help is expanding ammonium sulphate capacity to 33,000 tons.

The demand for water is great and, despite the heavy rainfall, water is wanted for irrigation on a large scale. Before the Japanese occupation in 1895 the Chinese immigrants had built dykes for flood control of some of the torrential rivers and had developed the irrigation of nearly 200,000 hectares. Numerous irrigation systems have since then been improved and many new ones established with help from Government and the JCRR. By the summer of 1951 the total irrigated area had reached 530,000 hectares, or about 60% of the total cultivated area. In many cases, of course, irrigation has been combined with improved drainage.



Rice paddies cover a large area in Taiwan. These lie at the base of the mountains on the west coast

Seed supplies

A system of pure seed supply has been instituted by the Government (Department of Agriculture), the farmers' associations and the JCRR for most of the main crops, including vegetables and tea. It is operated in three stages: foundation seed supplies, stock seed supplies and extension supplies. In the first stage, seed of an improved variety is multiplied at the provincial experiment stations for planting stock seed. This in turn is multiplied partly by the stations and partly by contract with farmers for planting extension seed which is sold to other farmers to replace their poorer stock. In the case of rice, increased yields of at least 5% are conservatively estimated to have resulted. In addition to a seed inspection service, JCRR has also subsidised the building of seed-drying grounds and storage bins to prevent admixture of pure seed with other varieties. Extension rice seed is annually available for planting 200,000 hectares, or about one-third of the total rice area. To maintain purity farmers are advised to renew their rice seed every third crop (two crops yearly).

Pest and disease control

A pest control programme for rice, vegetables and fruits is also in vigorous operation. Materials such as DDT, derris extract and other pesticides are supplied through the farmers' associations and have greatly reduced pest damage. The warehouse loss of rice in five to eight months caused by grain weevils and moths is estimated to average 5%, while for wheat and for sweet potato chips it may range from 15% to 30%. It is hoped to reduce this by more effective control by spraying the grain bins with DDT and mixing the grain and potato chips with Pyrenone powder. For the storage of big stocks of food, 158 warehouses have been repaired and 62 new ones constructed, increasing rice storage capacity by 40,175 tons.

Cropping conditions

Taiwan has 876,864 hectares of cultivated land, of which 528,097 are paddy fields. Cropping systems have been developed to meet varying local conditions. In the non-irrigated areas of the south only one crop of rice is grown each year from June to early December; in the north also, where there is no dry season, but winter temperatures are too low for good growth of rice, only one crop is grown. Elsewhere in the irrigated central and southern districts two crops of rice per annum are the systems, but in places rice and sugar cane are grown on a two-crop rotation system. Dr. Shen describes the two systems as follows:

(1) The first crop of rice is transplanted in late February or early March and harvested in June. A summer catch crop, mainly of green manure, is planted or interplanted in late May or early June and ploughed under in late July or early August before transplanting the second crop of rice, which can be done up to early September. This second crop is harvested up to late November. After that winter cropping is chiefly green manure, but in some districts it is sweet potatoes, flax, corn, wheat, tobacco or vegetables.

(2) The rice-sugar cane rotation is commonly practised on the Chia-nan Canal irrigation district in Tainan, where there is not enough water to irrigate the entire 150,000 hectares cultivated. A three-year rotation is followed comprising rice, sugar cane and sweet potatoes (or other crops) grown every year on each 50,000 hectares. Rice is irrigated from May to October north of the Peikang River, and from June to September south of the river; sugar cane from September to January north and from November to April south of the river. Sweet potatoes have little or no irrigation. Actually, the whole area is divided into 1,000 units of about 150 hectares each, giving 50 hectares each to the three main crops. The rice north of the Peikang River, grown in May to October, is followed by sweet potatoes, peanuts or other crops to September of the second year; sugar cane planted September to November of the second year is harvested in November of the third year to March of the fourth year, with catch-crops interplanted and ploughed under in April of fourth year as green manure for rice. The same rotation is followed south of the river, but about a month later.

In the irrigated districts of the north, where the first rice crop is harvested in July, there is no time for a catch crop before

the second rice crop is transplanted in early August, but the winter crop, for which the season is fairly long, is largely grown for green manure.

Rice varieties

Early-maturing rice varieties are grown, mostly *Oryza japonica* and *indica*, the former being Japanese and the latter native. Of these, *japonica*, with a sufficient amount of fertiliser, matures earlier, has less inclination to lay and yields higher than does *indica*, but with insufficient fertiliser the latter generally yields more than *japonica*.

During the Japanese occupation every effort was made to increase rice production for export to Japan—by better irrigation, drainage and flood control, by plentiful supplies of chemical fertiliser, improvement of varieties and cultural methods, better transport, warehousing and milling facilities and development of credit systems. The following table shows the rice production of Taiwan between 1900-50, also the home consumption, showing the declining *per capita* consumption rate with increasing population:

Some of Taiwan's rugged mountain terrain is shown in this photograph of Taloko Gorge

through military drafts and of fertiliser from Japan. Exports of rice to Japan accordingly fell to 166,000 tons in 1944.

PRODUCTION OF RICE IN TAIWAN, 1900-1950.

	Acreage		Yields per hectare		Total		Consumption		
	1,000 hectares	%	kg.	%	1,000 tons	%	per capita		Total (1,000 tons)
1900	325.6	100	943	100	307.14	100		—	—
1910	456.3	140	1,311	139	598.2	195		—	—
1920	500.2	154	1,383	147	691.7	225		kg.	—
							1925	158.1	631.3
1930	614.4	189	1,714	182	1,052.9	343	1930	151.77	683.8
							1935	111.9	576.0
1938	625.4	192	2,242	238	1,402.4	457			
1940	638.6	196	1,768	187	1,128.8	368	1940	123.9	719.1
							1944	138.47	905.0
1950	770.3	236	1,834	194	1,421.5	460			
							1950-1	143.44	1,112.7

Economic conditions

Population increased from 4 million in 1925 to 6.5 million in 1944 and from 6.8 million in 1948 to 7.5 million in 1950, excluding 600,000 military personnel. Exports for this latest year were only about 77,000 tons, as compared with an average of 658,000 tons in 1937-39. Exports of other products are given in the table.

During the war Japan encouraged rice production to the utmost and strictly controlled consumption in Taiwan, especially after 1941, when Japan faced a great food shortage. The farmers could save rice only for seed and their own meagre ration and were compelled to sell the rest to the Government (Japan) controlled farmers' associations for milling and selling at a controlled price. Under these conditions the farmers could hardly make a living and were reluctant to increase production. There was a shortage of both labour

The Chinese National Government took over the island in 1945, abolished food control and stimulated increased production of the main crops, including more particularly sweet potatoes. About 11% of these are now consumed for food, 85% for feeding pigs and cattle, and 3% for alcohol production. Under the Japanese regime they had been recognised as an important food crop, second only to rice, and today their status may be equal to or greater than that of rice. In the early period of 1900 to 1910 the acreage under this crop increased to 100,000 hectares, and by 1950 it had reached 235,000 hectares with yields of about 10 tons per hectare and a total production of 2.2 million tons. The crop is grown on dry land and stands adverse conditions better than does rice. The possibilities of improving the varieties grown and the yields appear also to be good.

In regard to food exports generally, those of rice, as we have seen, have declined considerably. Exports of sugar, tea and fruits have also dropped. Agricultural rehabilitation, despite outside aid, has not proceeded quite so rapidly as expected, so that the Government is faced with shortage of foreign exchange and is endeavouring to increase exports, *e.g.* to the U.S.A. and Japan.

EXPORTS OF PRINCIPAL TAIWANESE PRODUCTS (in 1,000 tons)

	1937-39 average	1948	1949	1950
Brown rice ..	658.42	—	—	20.00
Sugar ..	1,074.9	200.46	431.3	619.4
Tea	11.8	8.6	14.71	6.86
Bananas ..	142.55	25.49	12.62	11.60
Pineapples ..	57.86	0.38	2.62	5.98
Citrus fruits	9.47	11.37	3.04	1.13

Present food production

In co-operation with the China Mission of the ECA (Economic Co-operative Administration) and the JCRR, the Provincial Government is undertaking an ambitious programme to stimulate farmers' activities, improve production facilities and to stabilise food supplies.

There are in the island 620,875 farm households and an agricultural population of 3,880,000. This raises interesting comparisons between a numerous farm population, doubtless rather poor and without machinery on a relatively small area, and a much more sparse land population on a larger area and well mechanised. The questions involved cannot be discussed here, intriguing as they are, but it is noteworthy that little attention is paid to mechanisation, and, under the special conditions obtaining, this may be neither possible nor desirable; many of the farms are quite small, and of the total farm population 35% are owners, 27% partly own and partly rent their land and 39% are tenants. The latter occupy about 56% of the total cultivated area and their holdings average only one hectare each in area.

Formerly the average rent accounted for 50% of the annual major crop yield (rice) and the tenant farmers were thus in extreme poverty.

Land reform

In March 1949 the national land law was enacted under which rents were reduced and land tenure terms improved. Leases must be for not less than six years, and from his total rice crop of about 6 metric tons per hectare the tenant now pays in rent 750 kilos less than formerly, which makes a marked difference to his food supply and his standard of living. Rent reduction has helped to stabilise the rural social order and to reduce Communistic tendencies; it has also contributed to the

reduction of land prices and to the inauguration of a tenant land purchase programme.

General position

The general economic position, however, still remains difficult, partly owing to general world and trade conditions, but largely also on account of the present abnormal military position in the island. Inflation has been checked to some extent, by limitation of credit loans to farmers, and, indeed, such limitation is unavoidable, for the Government banks are at present unable to advance sufficient funds for the farmers' total needs. A high rate of interest has in consequence to be paid to many usurers, thereby increasing costs of production. The Food Bureau is now the sole agency for collecting rice from farmers through barter and credit loans, and from landowners through taxes in kind and compulsory purchases. The Bureau also barters rice for chemical fertilisers imported partly by ECA and partly by Government.

As already emphasised, one of the most important factors is the need for chemical fertilisers, for yields per hectare are still below those in pre-war years when fertilisers were more easily available. It has been suggested that more chemical fertiliser plants should be built to reduce dependence on imports. Not much can be done to extend the cultivated area by reclamation, though some coastal land has been reclaimed by empoldering. Deforestation on the hills has caused soil erosion and soil conservation and constant vigilance are needed. Irrigation, too, requires to be maintained, improved and developed. The Provincial Water Conservancy Board plans to increase irrigation by about 120,000 hectares.

As elsewhere, the well-being of the island largely depends on a balance being maintained between population and food production and imports and on a return to more normal peace-time conditions. The latter would involve a cessation or marked diminution of Communist pressure, when doubtless most of the mainland Chinese on the island would go back to China, thus easing the population problem a little. The question is: Can the population be stabilised at not more than about 8,000,000? Birth and death rate statistics indicate that this will be difficult, for the net population increase rate has risen to 32.15 per 1,000, or double that of 1912; and as health and food conditions improve the rate is likely to increase further, and unless the birth rate is checked the resources of the island will be insufficient to maintain such a number.

(*Photos : U.S.I.S.*).

Protecting young crops by planting windbreaks, in the Negev

Cultivation of Arid Zones

Research and Progress in the Near-East

ERIC HARDY, F.Z.S.

In view of the intensifying world food shortages and increasing world populations more and more attention is being turned to the possibilities of using the desert regions of the earth for productive purposes. In the new State of Israel the possibilities in this direction are being studied and in what follows some of the salient points of this work are described and discussed.

SINCE the war, interest in applied ecology and the study of the floras of the desert and semi-desert regions of the Near East have enabled considerable progress to be made in the cultivation of those arid zones that stretch from Algeria to India. Israel in particular has been forced by its increasingly difficult internal economy and rapidly expanding population to increase its home production of food and other economic crops by extensive irrigation and development of the southern semi-desert Negev, the historic dry-farming granary of Biblical Palestine which fell into neglect under Ottoman rule; also by an ecological survey of the border desert of the Arabah region north of the Red Sea.

A symposium on desert research held in Israel in May 1952 discussed practical co-operative work on this subject, and UNESCO arranged a meeting at Ankara with a similar trend.

The International Commission for Applied Ecology, created by the botanical section of the International Union of Biological Sciences, is building up an international network for research on planned land use. One of the schemes is the establishment of a chain of observation stations from Morocco to India and the production of climatic maps of the arid regions. It is also proposed to collect reports on the plant ecology of the regions and consider them at a further arid zone symposium in 1953.

Regional characteristics

Much of the desert land of North Africa and the Near East has not always been desert. It is largely the result of soil erosion, wind-blown dust-bowls having followed the destruction of trees caused by either charcoal-seeking bedouins who failed to replant, or the indiscriminate grazing of goats. The solution lies in irrigation from artesian wells or impounding the rainfall in storage reservoirs. It is also possible to develop certain economic plants suited to semi-desert regions. Thus in 1946 I led a collecting expedition down the arid Wadi el Arabah from the southern shores of the Dead Sea to the northern shores of the

Red Sea. At the request of Professor M. Zohary of Jerusalem, I collected seeds of *Haloxylon persicum*, a desert type of broom which had an astonishing ecological range and formed dominant associations in parts of the region. Professor Zohary identified this shrub with the 'Ghada' tree of ancient travel literature. The plant is of economic value for fuel as well as being of considerable phyto-geographical interest. Its presence suggests affinities with the deserts of Central Asia. Economically it seems to meet the need for a plant to cultivate in desert regions of very low water supply, for its stems would be a source of material for charcoal and its foliage supply grazing for camels and goats. The plant might also have a value for checking desert sand-drift.

Deserts of Western Asia

The four great deserts of western Asia are Sinai—the Negev of southern Israel, the Wadi Arabah (Judea-Ghor Jordan state), southern Iraq and the Syrian-Arabian desert, and they have all been the subject of limited botanical explorations. In the central part of the Syrian Desert, with annual rainfall of 95 to 210 mm. (3.8 to 8.4 in.), Zohary and Eig collected 175 species, 75% of which were annuals. Of the three main regions of the Syrian desert, the smallest number of plant species grows in the Saharo-Sindian region. The most important part of this desert from the point of view of agricultural development would be the Irano-Turanian zone, because the largest variety of plant life (588 species) grows there.

Plants of arid regions

Sir Basil Gould, C.M.G., C.I.E., pointed out a few years ago that in Baluchistan, India, in areas where rainfall is 50 to 250 mm. (2 to 10 in.) annually, the mesquite plant is useful for preventing sand-drift and wind erosion; the seeds are distributed by goats which eat the pods but do not digest the seeds. The plant flourishes in salty and sandy soils; it is a small, acacia-like shrub, *Prosopis pubescens*, sometimes called the 'screw-bean,' and its seed, rich in sugar, is eaten by Indian natives. An allied species, *P. glandulosa*, grows in Mexico and Texas. Persian clover ('shaftal' or 'shavdar') is cultivated in salty irrigated regions of eastern Persia (Seistan) and in Baluchistan, serving as green and dry fodder and also as a soil fertiliser. It is grown in Afghanistan and the Peshawar area for fodder, as it tolerates a temperature range of from 0° F. to 125° F. The Sind irrigation department has experimented with cereals in salty desert areas, sometimes soaking the seed before planting.

One of the most successful efforts at salt-desert cultivation I have seen was the former Jewish agricultural settlement of Beit Ha'arava, on the salty Ghor between the north shore of the Dead Sea and Jericho. Here a 15% salt content had been leached out of the sod by pumping fresh water from the Jordan into carp-breeding ponds banked with earthworks, for two years, after which the ponds were moved on to fresh desert and the old sites cultivated. Numerous sweetwater springs which occur along the sterile, salty shores of the Dead Sea have effected a similar leaching of the salt there and these regions now support a luxurious semi-tropical vegetation at places like Ein Geddi, Es Safiya and Ein Feshka. The Jews have a large-scale scheme in mind to cultivate the Wadi Arabah between their stations at Jebel Usdum at the south of the Dead Sea and Elath at the head of the Gulf of Aqaba on the Red Sea. An experimental acclimatisation garden has already been planted at the latter place, which has less than 1 in. annual rainfall and was formerly a completely barren Arab camel corps post. The change has been made possible by the opening of ancient water-holes in the vicinity.

The Wadi Arabah

The next generation is going to witness remarkable development in the Wadi Arabah area (the Aravah, or wilderness, of the Bible where the Israelities wandered on their journey from Sinai to Edom and Moab). Moses must have led the Israelites through this in winter when the brief foliage of the desert flora fed their flocks. In a report on the natural vegetation of this region (roughly 100 miles long) I listed 145 species of which some 60 belonged to the semi-arid region. At that time the only economic use made of this area was a small amount of camel-rearing in the southern part. Lawrence's great tree Ein Husb—a giant Zizyphus or Christ's thorn, possibly 1,500 years old—should have been taken long ago as proof of the possibilities. Today the Jews have made green patches in the desert by successful tree planting at their experimental station at Ein Yahav, 25 km. south of the Chatzevah oasis. Periodic green patches are appearing at other sites that are being developed, like Be'er Orah, 17 km. from the Gulf, where cows and goats are kept.

Effects of developments

These green patches which cultivation, irrigation and settlement have recently brought to the once-dry regions of the Arabah and the Negev are creating a problem by attracting flocks of small birds and herds of gazelle. I used to find the natural oases crowded with Asiatic scrub-warblers, bulbuls and other birds, and these and the periodic swarms of desert voles eating young trees are bound to create pest problems in the future.

The agricultural future of the once barren southern region of Palestine has been assured by the success of the Negev settlements following Dr. Ravikovitch's survey of the Negev soils, meteorological surveys by Dr. Ashbel and the successful boring for water in some places as well as by the use of the heavy precipitation of dew for cultivating certain plants. Duvdevani, of the Pardes Hanna Agricultural School, studied the Negev dew precipitation and

Semi-arid land bordering the araba of Israel-Jordan, whose development is contemplated

found that its volume amounts to 30 mm. per year, falling on half the nights of the year and most particularly during the rain-free months of June and July. Between 70% and 80% of the Negev's rainfall falls in October to May, but at the Gvulot settlement dew was recorded on 23 nights in June, totalling 2.9 mm., and on 25 nights in July, totalling 4 mm. This exceeds the rainfall in October and April and is less than that for May, while no rain at all falls from June to September inclusive.

The scarcity of water for Negev development has been met in part by resuscitating the Byzantine idea of conserving what rain does fall in sub-surface reservoirs, like the dam at Asluj (Revivm) on the edge of Sinai. Underground water from wells is usually in small quantity and often saline, like that from the British boring in Wadi Beersheba. An enormous amount of surface water is at times wasted where no sub-surface dams exist to store the occasional winter precipitations. An important deep well with a capacity of up to 88,800 gallons of water per hour with a chlorine content of only 25 pints per 100,000 was bored near Beersheba in 1952, giving this arid region greater prospects for agricultural and industrial development to a population of 100,000, according to Prof. L. Picard, the geologist. A 40 km. pipeline between the spring of Ein Radian and the Arabah port of Elath is scheduled for completion in the summer of 1953. Since the establishment of the State of Israel, the water sources have been increased from 215,000,000 cu. m. to 600,000,000 cu. m. A 'Conquest of the Desert' exhibition is being staged in Jerusalem in July 1953, whereby foreign as well as Israeli exhibits will be staged. In 1952 the first large crop of *Juncus maritmus arabicus*, a rush tolerating saline marshes in the Negev-Arabah region, was exported to British mills for paper making.

It has also been shown that a rational system of crop rotation and soil preparation will increase by four or five times the yield from unirrigated land. Tamarisks, eucalyptus, casuarina and other forest trees will serve as wind-breaks to save soil and, on arid land, plants such as at Beersheba and Gvulot and orchard fruit trees may be grown by dry farming methods as an economic mainstay. Olives, peaches, apricots, almonds, pomegranates and vines have also given satisfactory growth with only a small quantity of irrigation water to help in the first two years of growth, after which they can summer without such aid. On less porous soils less irrigation is required. Wheat, barley, maize and white radish were also grown successfully in the experiments in the Negev. Beersheba already has a Jewish population of over 10,000 which may possibly increase to 50,000, while the agricultural settlements are apparently the nuclei of future towns and should develop further when the Negev is linked with the Rutenberg electrical grid.

Harvesting grain in the Negev area of Israel

Negev vegetation

Dr. H. Boyko's survey of the wild vegetation of the Negev showed that *Artemesia Herba-alba* ('wormwood') dominates the less arid regions and *Anabasis articulata* (equally worthless for fodder) dominates the more arid regions. This is replaced in the adjoining Wadi Arabah by the more useful *Haloxylin salicornicum*. Tall feather-grasses grow naturally in the 200 mm. annual rainfall regions, short feather-grasses in the 150 to 200 mm. regions. Two acacias (the 'shittim' trees of the Bible) also grow in places and three plants of *Haloxylon persicum*, estimated to be 2,000 years old, have been located in the region with less than 150 mm. rainfall. For centuries the Negev plains were so seriously over-grazed by bedouin goat and sheep herds that the climax vegetation was altered to warrant a casual assumption that only the present unpalatable shrubs and perennials like wormwood could survive. But when wartime restrictions prevented grazing in certain areas, the feather-grass species, *Aristida* and *Stipa*, recovered some of their lost ground. The recent control of bedouin overgrazing has started the regrowth of a steppe grassland in the less arid Negev, just as it grew within the first year of the British restriction on grazing near Rutnub and elsewhere.

Over-grazing

Over-grazing has been the ruination of much semi-arid land in the Middle East. A large part of the 'desert border' in North Africa, Pakistan and Western Asia could be transformed into half-desert pastures by replacing the present dominant but worthless plants with suitable palatable fodder plants like *Haloxylon*, *Haplophyllum longifolium*, *Ochradenus baccata*, *Savignya parviflora*, *Farsetia ovalis*, *Panicum turgidum*, *Calligonum comosum*, *Argyrolobium uniflorum* and *Convolvulus lanatus*, which will all grow in the more arid areas. This would require mechanical seed-sowing just before the short rains, otherwise the seeds would dry out. Negev experiments have shown that only seeds which had blown into tiny holes germinate, for dryness and heat are too strong on the sun-baked surface and sowing would have to be done in holes 2 to 8 cm. deep, which retain moisture longer than the flat surface and are cooler. The Americans have successfully sown 'pellets' or seed-containers in desert areas by using small aeroplanes of the Army Air Co-operation type. Perhaps a track-driven vehicle could be adapted to make tiny holes for seeds. Haloxylon shrubs have such a great tolerance in aridity and temperature that for natural regeneration it suffices if rain floods occur very occasionally to permit the seeds to germinate and enable roots to reach the subterranean water table.

Land development

Finally, we come to the basic principles of desert and semi-desert land development. The advice of the trained plant ecologist is as essential as that of the hydro-

engineer if development schemes are not to risk vast quantities of public money.

Hydro-engineering works, from the drainage and operation of irrigation in the great Hulah swamp in the upper Jordan valley to works in the Euphrates valley and the Sudan, show the need for plant ecologists. Plant and animal life in these areas are decisively changed by such schemes because they alter the subterranean water level. This limits the species of plant that can grow, and examination of the flora, in relation to the depth of its roots, can show the ecologist the level of the underground water. Alteration in the flora can indicate a dangerous fall in the water table. Before any big scheme is commenced it is vital therefore to know how far it will change the prospects for plant life and if it is likely to drop below the optimum level for agriculture. The natural vegetation of an area can thus indicate the possibilities of the soil and the climate. It was Strassburger who first showed how certain plants indicate an unexpected occurrence of calcium carbonate in the igneous region of the Orleans forests in France, and I have personally seen similar plant indicators, *e.g.* lime-loving mosses and ferns, etc., showing where calcareous pockets occur amongst the millstone grit of Hardcastle Crags and other Pennine valleys. Plants, especially old olive tree bases, also indicate the degree and speed of soil erosion over many years, and a study of the climax-vegetation in comparison with the historical vegetation will show the degree of overgrazing an area has suffered. The ecologist can also tell if the building-up of new soil can take place faster than erosion, if plant-screens, reservoir dams and other means are used to divert rainfall floods. Thus more than a thousand old olive trees were measured in Palestine by Boyko to prove their value as indicators of the relation between soil-replacement and erosion.

Boyko also expounded his 'geo-ecological law of distribution' which indicates the factors of climate, weather and water which allow plants to grow in particular situations. Briefly, this shows that the same cycles which influence the local appearance of a plant in the landscape also influence its distribution over wide geographical areas. By studying geographical distribution of a plant, conclusions can be drawn about its distribution in a small local area or the requirements necessary for it to be cultivated there. Thus the biological requirements of plants can be drawn up by the ecologist for practical use by the forester, the horticulturist and the agriculturist while developing neglected desert regions when exotic plants have to be introduced to make them productive.

Ploughing the fields of the newly established Beth Hashitah in the Vale of Jezreel

The traditional classification of forest based upon the humid conditions of the tropics or the temperate clime of Europe and America fails to meet the conditions of semi-arid areas at lower altitudes where surprisingly wide differences in vegetation are caused by comparatively small changes in the angle of inclination of the site towards the sun, causing differences of insolation intensity. It has been suggested that this is a decisive criterion in semi-arid zones and as such is an important factor in regeneration and forestry schemes. Thus in the semi-arid near-deserts of the Mediterranean there have been found the remains of ancient forests which have been destroyed by man, usually the bedouin, followed by erosion and economic decline. They were mostly regions on the climatical borders of the great global forests and their destruction exposed the land to external conditions under which the forests could not regenerate. Thus Stebbing has called attention to the remarkable advance of the Sahara southwards in 300 years, and Sears has shown the similar progress of the American deserts.

Cyprus and Palestine are the best examples of successful regeneration of overgrazed, semi-arid regions, although much still remains to be done there.

The study of the soil-binding power of the root systems of plant associations is important in regions subject to soil erosion. Soil formation is largely dependent upon climate and the high temperatures of semi-desert areas accelerate the physical, chemical and bacteriological processes which break down rock and animal and plant remains to make the sand, clay and humus of raw soil.

Conclusion

To summarise, vegetative regeneration has now been proved possible in overgrazed half-deserts, but the physical and climatic conditions govern the operations to such a fine degree that the co-operation of trained plant ecologists is necessary to ensure success. Unfortunately, at present there are insufficient trained and experienced ecologists available for a world-wide plan of development, and in some places political conditions handicap the exchange of ideas and experience.

In order to develop semi-arid regions it is necessary to follow the plan of studying the composition of the plant communities, the periodicity of climatic extremes like rainfall and drought, the palatability and nutritive value of the natural vegetation as well as soil protection, the regeneration of pastures lost by over-grazing in the past, the possible introduction of fodder trees, the use of indicator scales of overgrazing, the lowering of subterranean water-levels etc., and estimating the carrying fodder of grazing areas. In addition must be studied the nature and slope of the land, the possibilities of irrigation by conserving irregular precipitations of rain which normally are wasted, the possible use of aeroplanes or caterpillar-tracked vehicles to sow suitable seeds and the possibility of the wind blowing of mass-scattered seeds. It is well known that many of the semi-desert regions of the world today were not always so, but carried a richer vegetation which man destroyed. What is comparatively new is the knowledge that these semi-arid regions can regenerate their lost flora. Israel is making strenuous efforts to bring the semi-arid half of her new State under cultivation to support a much higher population. Considerable progress has already been made in the southern Negev and field trials and experimental plantations are now being extended to the great Wadi Arabah along the frontier with the State of Southern Jordan. The experience in these regions could be used in other parts of the world.

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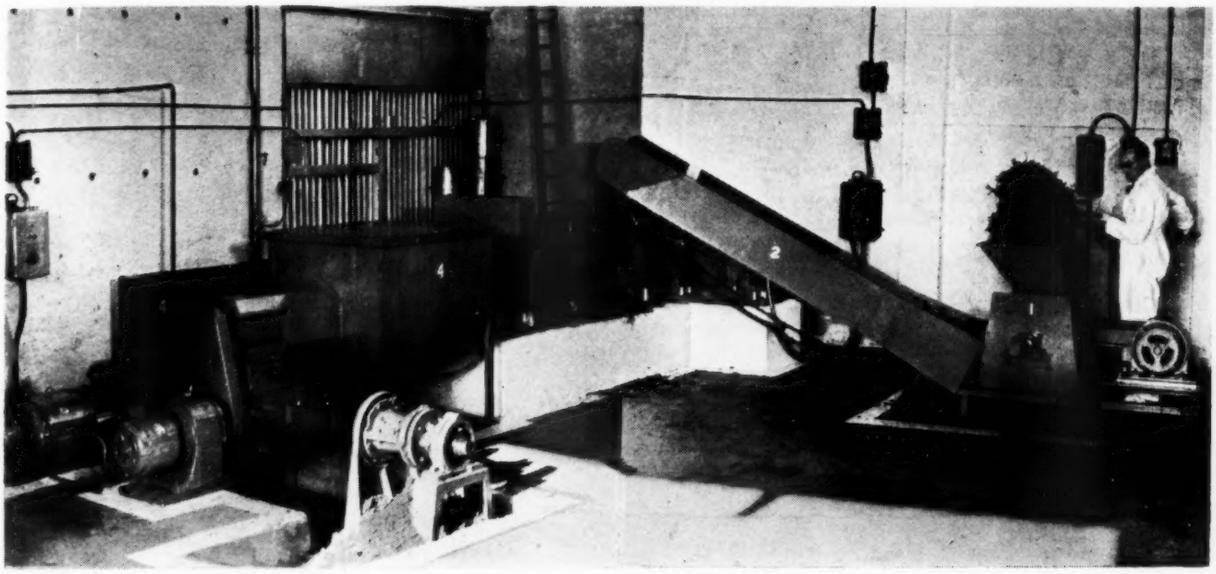
(Photos: Pp. 59, 61 and 62, Zionist Information Service.

Protein Extraction from Green Crops

A Promising New Method of Producing High Quality Feeding Stuffs



Plant for the production of Protess having 30% to 45% protein content, according to the crop processed. Each unit plant will handle about a ton of raw material per hour

After many years of experimental work, Mr. W. T. Powling and his son have devised a plant and process for the production of feeding-stuffs from vegetable and other waste. The object of the process is to separate mechanically the moisture, fibre and a nutrient concentrate, which they have called Protess, from green crops, vegetables, roots, fish and meat offal.

BEFORE the war, protein in such forms as fish and meat meal and the residues of the seeds from which vegetable oils had been crushed was cheap and plentiful. This situation no longer existing, Mr. Powling and his son started their experiments with a view to finding some economical method of extracting protein from the vegetable growths.

The amount of protein an animal can take in is dependent upon the amount of fibre it is capable of consuming; even the heaviest consumer of fibre is unable to take in sufficient protein for present-day intensive feeding. For other types of animals, such as pigs and poultry, the limitation is even greater. Hence, the necessity for the feeding of concentrated protein.

Raw materials

Among the materials treated by the new process are grass, clover, lucerne, sugar beet tops, pea haulms, beans (before and after podding), lawn cuttings, nettles, bracken, coarse riverside grass, and cuttings from roadside ditches.

All the crops must be green when processed and not sear; an important point is that there appears to be no real need to be particular as to the stage of growth attained. Although a greater bulk of fibre has to be processed in a fully matured crop than in a young crop, the total recovery of Protess per acre and the protein contained therein is much the same. These facts alone indicate the economic possibilities of the process as it means that harvesting does not become an urgent matter and the season for processing can be extended very considerably.

The process

The process is a simple one. The raw green crop is passed through a pre-chopper to reduce it to short lengths. It is then elevated into the first 'Protessor' in which the cellular structure of the material is broken down. The residue is then washed and passed to the second 'Protessor' which ejects the fibre, the dilute Protess being run off and heated to cause precipitation. The surplus water is then run off and the precipitate is available for storage or for further concentration by drying. The fibre which has been ejected has a moisture content of about 30%, and a protein content of about 6% to 8% on a dry basis, thus providing a good bulk feed. It can be ensiled or easily dried. The fibre residue is in a warm, damp condition as it leaves the plant and if spread on the floor up to about 2 ft. deep, it will dry out fairly quickly by means of its own generated heat, after which it can be stored. Alternatively, it can be ensiled, or dried out and ground into a meal which can be cubed if desired.

There are also possibilities that, in addition to their use as a good bulk feed, certain fibres may be suitable for paper making, fibreboard manufacture and similar industrial purposes. It is also an excellent material for composting or even rotting down into organic manure.

The Protess, which can be sorted in its semi-liquid state in tanks or silos, usually has a protein content on a dry basis of between 30% to 45%, according to the crop processed; some crops give even higher figures. Practically all the carbohydrates and the minerals in the crop are contained in this final product, but usually not more than about 4% to 6% of fibre is present. The only chemical used is a small amount of preservative.

Uses of Protess

For its utilisation it can be mixed in its liquid or cheese form with cereals, either as a wet or dry mash. It can be

cubed with cereals, or it can be mixed back with some of the extracted fibre residue. In some cases the protein content of the feed can be controlled.

Powlings Patent Processes, in conjunction with E. H. Bentall and Co., who have been responsible for the translation of the laboratory scale experiments to the present full-size commercial plant, believe that with further refining Protess may find considerable use as a nutritional substance for inclusion in manufactured soups, sauces, and similar foods for human consumption.

Quite apart from the fact that farmers now have a process available to them for the storage of green crops without recourse to drying, and the benefits of having ample supplies of a high protein content substances for feeding purposes, the Powling process is likely to have other uses in agriculture.

For example, stinging nettles produce a Protess having a higher protein content than most present-day crops. Furthermore, by value of its high chlorophyll content, there is the possibility of a very important market for the product in the industrial field. A very pure chlorophyll has already been produced from Protess on a laboratory scale.

One of the bugbears of farmers and horticulturists is the glut crop. Since most crops can now be processed to produce a valuable product, the ploughing-in operation can become a thing of the past.

Future developments

Other possible developments are the production of Gari flour, starch and tapioca from cassava roots, the production of fruit pulps, the extraction of water from peat, of sugar from sugar beet, and of high protein-bearing concentrate from fish and fish offal.

Each unit plant will handle on average about one ton of raw material per hour. The cost of processing varies with different crops and different conditions of the crop, but on small-scale production, say about 500 hours working per year, including depreciation, capital investment and substantial allowance for spares and repairs, in addition to wages and fuel, the cost would be rather less than grass drying.

On large-scale production, say 4,000 hours working per year, the cost would be appreciably less and probably well below £10 per ton of dry Protess. In both cases there would be the value of the residual fibre to be taken into consideration, which would bring the cost of the Protess still further below that of dried green crops.

Utilisation of feeding-stuffs

As the process is a new one, there is naturally no previous knowledge or experience to go by as to how best to utilise the products of the process as feeding materials. It is not difficult to visualise the possibility of feeding-stuffs and other industrial manufacturers collecting the liquid or cheese Protess for further processing in their factories. A further development might be for an industrial concern to rent plants out to farmers, provided the latter supplied the former with a certain quantity of Protess per year.

The whole process provides an endless list of possibilities which await development in the manner in which those with initiative think most appropriate.

(From *Food Manufacture*, **xxviii,** 1, 19, January 1953.)

Controlling a Toxic Prairie Weed

RANCHERS and stockmen in Nevada, Idaho, Utah, Wyoming, Oregon, Montana and California are making a concerted effort to eliminate a poisonous weed named halogeton, that has established itself on the Western range on an estimated 750,000 to 1,000,000 acres.

Two Caterpillar D4 Tractors with root plane attachments clearing range land of halogeton and sage brush, north of Wells, Nevada

The cattle and sheep population in the various states has been affected to some extent by the spread of halogeton during the past 15 to 20 years and since authorities agree that complete eradication is no longer feasible over most of the weed's range, efforts are being made to control it through reseeding, chemical and mechanical means, and by range management.

According to the booklet, 'How to Live with Halogeton by Limiting its Spread,' issued by the Agricultural Extension Service of the University of Nevada, in which state the infestation is most severe, small amounts of halogeton consumed by grazing animals cause no ill effects. Taken in larger amounts, however, halogeton becomes toxic. The toxic dose is in proportion to the weight of the animal and the soluble oxalates contained in the plant.

During the winter months two effects tend to reduce the toxicity of halogeton; the shedding of leaves which are much higher in oxalate content than the stems, and the leaching of water soluble oxalate crystals from the plant by rain and snow. By spring the plant has lost its toxicity and there is small danger from it until the next crop arrives.

An annual, halogeton germinates from seed in early spring and grows rapidly in warm weather. It ranges from a few in. in height to two or more ft., depending upon moisture and competition with brush or other vegetative cover. It is a prolific seed producer and the seeds are winged, enabling the wind to carry them to new areas. They are also spread by automobiles, trucks, road machinery, birds, insects and animals.

The U.S. Bureau of Land Management estimates that 5,000,000 acres in the overall infestation can be benefited by brush clearing and seeding operations.

Although a great part of the control programme for the eradication of the weed provides for brush clearing and reseeding, eradication has been extended in small, isolated areas by a chemical spray.

Two areas in which the Bureau of Land Management has been successfully battling halogeton with tractor-drawn implements are in Paradise Valley, Nevada, about 40 miles northwest of Winnemucca and in an area located 60 miles north of Wells, Nevada.

In Paradise Valley, for instance, the Bureau has been using two 81 h.p. Caterpillar D7 Tractors to pull two 13ft. 6in. John Deere-Killifer disks to disk sagebrush and halogeton and prepare for reseeding this rangeland with Crested wheatgrass. North of Wells the Bureau has been employing four 43 h.p. Caterpillar D4 Tractors to pull tool bars with root plane attachments prior to seeding.

Crested wheatgrass is used almost exclusively in the seeding operations. It has been found that Crested wheatgrass will replace halogeton in two or three years in areas which have eight or more inches of precipitation.

Drug Plant Cultivation in the Netherlands

K. J. H. VAN SLUIS

The cultivation of drug plants has lately assumed some importance in Holland, especially since the end of the last world war. A general account of the industry, recent developments in connection with it and the more important drugs grown is contained in the following article.

THE cultivation of herbs in the Netherlands is by no means a new branch of horticulture. It was started by an Amsterdam pharmacist in 1494 to supply his own shop. In the following four centuries herb cultivation had but a poor existence till in 1935 Mr. van der Slikke started scientific investigations in this field, in collaboration with the Dutch Society of Herbs and a number of progressive gardeners. Thanks to this activity, immediately after World War II there appeared to be a fair chance of extending herb cultivation by supplying growers with seed and plant material of improved quality.

Development of drug plant cultivation

Post-war herb growing in the Netherlands has concentrated on a small number of species which flourish in the Dutch climate and in this article only the drug plants will be dealt with. The changed attitude towards herb cultivation was greatly encouraged by the severe drug shortage during the German occupation and government and industry have done much to stimulate interest in herb cultivation.

Backed by government subsidies growers' societies have erected modern drying plants at Westergeest and Doornspijk, and a third modern drying plant has been acquired by enlarging and improving an existing small one at Veghel-NB. Cultivation of herbs is more or less bound up with existence of a nearby drying plant, since fresh herbs usually suffer damage when shipped for long distances—particularly leaf and flower crops. Seed and root crops are less susceptible to shipping damage.

Economic aspects

In 1949 the total herb growing area covered 180 hectares and in 1950 this increased to 198 hectares; in the 1951 season the area was doubled once more. Provided only high quality products are grown and shipped, the financial returns of herb cultivation can be very favourable. This is not only due to large home demands on the part of pharmaceutical, cosmetic and flavouring industries but to demands from markets abroad as well.

The largest foreign customers have been Great Britain, Belgium and Italy, and Dutch traders have in the last five years won a not unimportant share of the drug trade in world markets; this obviously must be attributed to the fact that Dutch growers harvest an exceptionally high quality product. In the U.S.A. also Dutch produce is arousing much interest, which has been instrumental in liberating 1,500,000 guilders from Local Currency Funds to stimulate drug cultivation.

Before World War II Germany played a dominating role in this field, acting primarily as traders for the Balkans and Eastern Europe, Poland and the Soviet Union. After the war these suppliers fell off and former drug importing countries developed home cultivation or changed to the use of synthetics. Such was the situation when the Dutch government decided to stimulate drug cultivation within its territory and to create and maintain a sound foreign consumer market.

Small holdings adapt themselves to drug cultivation since family labour favours the high labour demands made by these crops, particularly the leaf crops. Dutch herb growing practice involves not less than 86 species of which 26 are the most important. Some of these are dealt with in detail below.

Milfoil

(*Achillae millefolium*)

Milfoil is multiplied by cuttings of adult roots. For several successive years the Experiment Station at Buitenpost maintained experiment gardens planted with milfoil. Development is always good except in dry summers, when yields remain below average. Average yields are 411 kg. of fresh herbs or 61 kg. of dried herbs per 100 sq. m.

It is planted out in April at 8 in. x 12 in. It is essential to control weeds during early development. Harvest is started at the first sign of blooming.

Marshmallow

(*Althaea officinalis*, Linn.)

Multiplication of marshmallow is by slip shoots or seed. Planting is started in mid-May at 16 in. x 16 in. Water-retaining, deep-worked sandy soil is preferred. Prior growing of early vegetables increases returns. Harvest is from October to November.

To market gardeners marshmallow is an attractive crop that can be grown after early vegetables or combined with some other vegetables. Yields amount to 24.5 kg. of major roots and 22.5 kg. of minor roots per 100 sq. m.

Belladonna

(*Atropa belladonna*, Linn.)

Multiplication is by seed, but germination depends on the prevalent temperature. Growth is best in sheltered gardens. Belladonna is very susceptible to frost and, owing to the rapid development of leaf in summer, an abundant supply of water is required; but too wet conditions may be harmful. It shows noticeable reaction to nitrogen and after each leaf harvest an addition of nitrogenous fertiliser is necessary for the growth of new leaf.

Sowing is done in February in the glasshouse or about mid-May in the field; 30 gm. of seed suffice to cover 100 sq. m. of garden surface. Weed control is essential and leaf can often be harvested twice in one season. In winter belladonna plants must be covered with a thick straw layer to shield the plants from frost damage. The plant is a biennial, yielding leaf in the first year and leaf and roots in the second.

Atropa is preferably sowed in seed beds under a glass cover. The resulting young shoots can be planted out in the field. A sheltered, mildly warm garden ensures good total yields, good leaf size and presumably also satisfactory alkaloid contents. It is essential to start cultivation with sound tillage of the soil since good water-retaining soil assures full development of plants in dry periods. It is advisable to strip big leaves one by one. The plants will soon form new leaf, after which another harvest can be obtained.

By selection of plant material at the experimental station of Buitenpost, yields have been increased to 170 kg. of fresh leaf (or 27 kg. of dried leaf) per 100 sq. m. of garden surface in the first year, and an average of 110 kg. of fresh roots (or 31 kg. of dried roots) per 100 sq. m. in the second year.

Marigold

(*Calendula officinalis*, Linn.)

The amount of marigold seed required to cover 100 sq. m. of garden soil is 50 gm. Sowing extends from mid-March to July. Only the flowers are harvested, which are used to obtain certain vegetable dyes, and for the preparation of certain homoeopathic remedies.

(*Carduus bennedictus*, Linn.)

Fifty grammes of seed suffice to sow 100 sq. m. of beds, preferably spaced at 6 in.; during development lines are thinned to 12 in. distance. As soon as sufficient flowers appear plants can be harvested. In the Netherlands this crop is no longer grown commercially.

Thorn-apple

(*Datura stramonium inermis*)

The 'thornless' thorn-apple is a leaf crop which belongs, like the Nightshades, to the Solanaceae. Germination of seed depends on the temperature and plant growth is best in sheltered gardens, while in winter plants need a cover of straw.

Thirty grammes of seed will plant 100 sq. m.; sowing time is from April to mid-June. Pre-germinated seed is preferred for sowing straight in the field. Leaf must be gathered regularly and sent to the drying plant.

Foxglove

(*Digitalis lanata*, Ehr.)

Development of this plant runs parallel to that of *Digitalis purpurea*, dealt with below. Planting occurs in May at distances of 12 in. x 12 in., the foliage closes in fairly late in summer and the harvest is from August to September. Cultivation of *Digitalis lanata* requires much care.

Foxglove

(*Digitalis purpurea*, Linn.)

The foxglove is also a leaf crop that gives one or two harvests a season. It is preferably sown in seed beds under glass cover and the young plants planted out at 12 in. x 12 in. in cloudy weather and given a dressing of fertiliser. Leaf can be harvested twice a season. Foxglove can also be grown after early vegetables, in which case the young plants are planted out in the last days of June. In this way, however, only one leaf harvest of 150 to 170 kg. per 100 sq. m. can be obtained in a season. Each leaf harvest must be sent to the drying plant without delay to maintain a high content of digitalin.

The Drug Plant Experiment Station has been investigating digitalis for many years and many different forms have been evolved by selection. The crop is harvested from late June until early in October. Yields per 100 sq. m. amount to 240 kg. of fresh leaf or 30 kg. of dried leaf.

Cold weather and slight frost have no harmful influence on the digitalin content of the leaves.

Annual henbane

(*Hyoscyamus niger annuus*)

Annual henbane is usually sown in lines spaced at 12 in. about mid-July. Under these conditions plants will not form seed but will develop a short and stubby shape with ample leaf formation. The leaf is gathered in September.

At the experiment station pure-bred seed has been obtained from isolated plants by self-pollination. To grow annual henbane 30 gm. of seed are required to cover 100 sq. m. of garden surface.

Biennial henbane

(*Hyoscyamus niger biennis*)

Biennial henbane was first grown in Holland in the 1949 season and very satisfactory results have already been reported. It was sown *in situ*, spaced at 12 in. x 12 in., and yielded a harvest of 156 kg. of leaves per 100 sq. m. One gardener planted henbane in combination with head lettuce; this was very attractive since combined returns amounted to 50 guilders per 100 sq. m. of cultivated area. Biennial plants in the first year produce only a rosette of leaves but in the second year flower stems arise and after seed formation the plants die. In the first year some leaf may be gathered from the rosettes but in the second year when the plants flower a good harvest of leaf is yielded.

Lobelia

(*Lobelia inflata*, Linn.)

Lobelia also belongs to the biennial plants. Its cultivation has been set up as a field experiment in the province of Friesland. 30 gm. of seed suffice to plant 100 sq. m. It is best sown about mid-May in humid soil. Lobelia develops well in lightly shaded gardens. The crop is cut at the flowering stage in August and September and the cut plants are dried—riddles yielding a relatively large amount of seed as a by-product. If only seed is desired the entire crop can be cut down in October.

Chinese rhubarb

(*Rheum palmatum*)

The Chinese rhubarb grown in the Netherlands originated from the mountain districts of Western China and Eastern Tibet. The botanical name is *Rheum palmatum*, Linn. Var. *Tanguticum Maximowicz*. Certain glucosides are the active principles.

Plants with deeply cut-in leaves are said to yield the best rhizomes. Colour differences of root-bark appear to be of little importance, although rhizomes with yellow bark yield a lighter coloured end-product. Selections aim at obtaining heavy, round rhizomes with as few adventitious roots as possible. Multiplication of Rheum is by seed and by cuttings of mature root-stocks. Seed usually is sown in seed beds. Good tillage of the soil is a necessary prerequisite. Cold and sunlight retard germination. Sowing lines are spaced at 12 in. and 1 kg. of seed suffices to sow 100 sq. m. Under favourable conditions the plants come up within a fortnight. First year plants will develop only a number of small leaves; in the autumn the plants can be set out in the field.

Tearing or cutting roots for multiplication purposes is only done with some of the best species. A four-year root can be divided into three to four parts each showing two or three eyes. Good weed control is essential to obtain good yields. Dressings of nitrogen fertiliser in June assist crop development. In the following spring plants are dug up to be replanted at $3\frac{1}{2}$ ft. x $3\frac{1}{2}$ ft. In the third year big and deeply indented leaves make their appearance. Chinese rhubarb asks much of the soil, but leaves it clean. After being dug up and cleaned the big root stocks are peeled and sliced. Sliced roots must be dried immediately. In storing dried root slices it is necessary to protect them from insect attack, particularly from wood fretter. Yields of fresh roots may amount to 350 kg. per 100 sq. m., and since the drying ratio is about 1 to $3\frac{1}{2}$, 100 kg. of dried root is a normal yield from 100 sq. m. of soil surface.

To obtain seed a number of selected plants are left in the ground. Care must be taken that no flowering plants of the common rhubarb occur in the vicinity, since Chinese rhubarb is easily cross-pollinated by the common rhubarb plant.

Chinese rhubarb sometimes exhibits yellow spots on the leaves, due to a lack of potassium, while periodic dressings of lime are essential to prevent soil acidity. Chinese rhubarb is usually considered an attractive and lucrative crop.

Plant diseases and insect pests

In some growing districts a withering disease on atropa plants occurs. This is controlled by seed disinfection. Gathering of drug plants infested by insects is not allowed. An effective remedy for insect attack is to spray plants one month before the harvest

with an insecticide that loses its toxicity within two to three days, *e.g.* a HETP preparation.

Rust often attacks a number of drug plants, particularly *Digitalis lanata*, *D. purpurea* and *Althaea*. Apart from cultivation methods rust infection also depends on weather conditions.

Aphid attacks often retard plant growth. This is particularly disadvantageous when above-ground parts of plants are to be harvested. Root crops are often allowed to restore themselves from aphid attack. To combat leaf aphids one spraying with Pyrethrex usually suffices under favourable weather conditions.

Drying plants

As mentioned there are at present three drug drying plants in the Netherlands. Two new ones, recently built at Doornspijk and Westergeest, were designed by the technical department of the Dutch Organisation for Applied Scientific Research (T.N.O.) and constructed by the N. V. Werkspoor of Amsterdam. Each drying plant comprises one continuous tunnel dryer and two intermittent kilns. Fresh herbs or roots are spread on trays and stacked on tram cars that are slowly passed through the tunnel dryer in about seven hours. The drugs are dried with warm air at about 70° C. The tunnel dryer has a heating surface of 300 sq. m. Heated air is blown through it in countercurrent with the trucks so the nearly dried herbs meet water-free warm air.

The cost of erecting the drying plants has been advanced by the Dutch government with the intention that the co-operative societies will ultimately take them over. The plants have proved very effective and drug plant growers in other districts are anxiously awaiting the erection of more drying plants by the Government.

ACKNOWLEDGMENT

The author wishes to acknowledge the courteous and expert assistance of Mr. J. P. L. L. A. Burg, government official accredited to the Department of Agriculture, Mr. A. P. v.d. Hoek, Agricultural Engineer, State Horticulture Consultant and director of the Plant Experiment Station of Buitenpost, and Mr. I. Jansma, chief gardener at the Experiment Station, for providing him with data used in this paper.

Cultivated Oil Export Ordinance, Nigeria

In the article on 'Aspects of British Colonial Agricultural Law,' Part III, by Mr. G. B. Masefield, which appeared in our October 1952 issue, our attention has been drawn by The United Africa Company to the fact that the Nigerian Oil Palm Ordinance (1935), referred to in the second paragraph of column two on page 358, has recently been repealed; in any case this ordinance while it was in force only applied to oil produced by oil palm plantations owned by Africans.

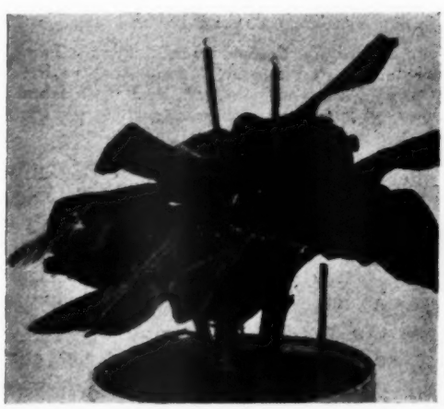
Bunchy Top Disease of Bananas in New South Wales

H. J. CANN, H.D.A.

District Fruit Officer, Coff's Harbour, N.S.W.

Bunchy Top disease has been responsible in the past for considerable losses, not only among bananas but also other musaceous crops, notably Manila Hemp in Australia and other countries in the Eastern Hemisphere. It is a virus disease transmitted by an aphid. The following account tells how the disease has been successfully controlled in New South Wales.

Banana plants infected with bunchy top. This rosette stage of the disease is now rarely seen in N.S.W. Infected plants are usually detected before the 'three-leaf' stage



Two healthy banana plants the same age as those in the other picture and grown under similar conditions

BUNCHY top is a virus disease of bananas and other members of the genus *Musa*. In New South Wales it may affect all types of banana plants.

The disease is carried from an infected plant to a clean plant by the banana aphid (*Pentalonia nigronervosa*). The banana aphid will live only on plants which belong to the banana family. Bunchy top disease can also be spread by planting suckers which are infected by the virus.

From a banana grower's point of view the main effect of bunchy top disease is that generally the diseased plant will not bear a bunch. If the plant is infected very late in its life it may throw a bunch, but even so the plant is a source of infection to other plants.

Bunchy top disease causes the leaves of banana plants to shorten, grow more upright and bunched together; it is from the last symptom that the name is derived.

History

Bunchy top disease was first reported in Australia in 1913. From 1913 to 1922 there was a marked extension of banana plantings in New South Wales and bunchy top disease, the cause of which was then unknown, was spread by using infected planting material. The disease was spread rapidly and extensively so much so that at that time a fruit officer of the Department of Agriculture reported: 'Every plantation in the Tweed and Brunswick districts is infected with bunchy top. There are at least 800 deserted plantations with an approximate area of 5,000 acres. Fully 90% of the area producing bananas in 1922 had gone out of production.'[1]

By the late 'twenties bunchy top had become a limiting factor in banana production in all of the growing area of New South Wales, except the Coff's Harbour district which has always been free, and the Machsville district which had only one small pocket of disease.

In 1924 a committee was formed to investigate the disease, members being Professor E. J. Goddard, University of Queensland; Dr. C. J. Magee, now Chief Biologist, N.S.W. Department of Agriculture; Mr. H. Collard, formerly of the Queensland Department of Agriculture and Stock. By 1926 they had established the fact that bunchy top was a virus disease and that the vector was the banana aphid.[1]

The committee made recommendations for controlling bunchy top and in 1927 the control of the disease was placed in the hands of the New South Wales Department of Agriculture. Deserted and neglected banana plantations presented the first problem: 'All the plantations and acreages first had to be destroyed before a commencement could be made with the restoration of the industry. When this was achieved, planting of new areas was permitted in 1928 with known disease-free suckers.'[2]

Up to 1934 disease control measures were quite effective and bunchy top was kept in check, but in 1935, owing to a fall in returns due to overproduction, growers became less keen to control disease in their plantations and bunchy top began to spread again quickly.

It is possible now to look back and say that this phase in the industry was a blessing in disguise, as it forced good growers to realise that bad growers could be a menace to the banana industry and that co-operative control was necessary.

In 1935 the Banana Growers' Federation Co-op. Ltd. financed a scheme to control disease in the worst infected plantations and from then on this bunchy top control scheme grew until after a few years it embraced all areas where bunchy top was known to exist.

The administration of the disease control was and is, however, still in the hands of the Department of Agriculture.

Present position

Now, bunchy top has ceased to be a limiting factor in banana production and providing control is not relaxed, and that prices of fruit to growers are remunerative, production can still be increased in New South Wales.

The following table gives the estimated production of bananas in New South Wales in past years:

	Bushels
1919	315,000
1922	805,000
1925	245,000
1928-29	141,750
1934-35	1,817,837
1949-50	2,754,100

The incidence of bunchy top has steadily declined from 1937; today it is ' at an all time low.' It is very rare now to find a plant in which the disease is well advanced and today there are many men growing bananas, in what were at one time bad bunchy top areas, who have never seen a bunchy top plant.

The table in the next column shows the incidence of bunchy top in New South Wales.

Diseased leaves with the vector, the banana aphid (*Pentalonia nigronervosa*)

Year	*Bunchy Top plants per 100 acres*	*Year*	*Bunchy Top plants per 100 acres*
1937	269	1944	33
1938	151	1945	36
1939	95	1946	24
1940	61	1947	36
1941	51	1948	20
1942	53	1949	20
1943	43	1950	20
		1951	15

How the results were obtained

To achieve the reductions in bunchy top plants set out above quarantine areas were gazetted which covered all commercial banana growing regions in New South Wales. The movement of banana plants in and between quarantine areas is regulated and it is necessary to have a permit to plant or move any banana suckers. The responsibility for issuing permits rests with bunchy top control inspectors who are stationed in the quarantine areas. These men are fully aware of the disease position in the plantations of their inspectorates and will not issue permits to move suckers from bunchy top plantations, or permits to plant in locations where bunchy top may become a menace.

Rigid control of planting material has been one of the greatest factors in reducing the spread of bunchy top.

Nine bunchy top control inspectors were appointed by the N.S.W. Department of Agriculture. These men have a very intimate knowledge of the banana industry in general and of bunchy top in particular. Besides their duties, previously mentioned, they have control of gangs of bunchy top detectors. These detectors are the men who actually find and treat the diseased banana plants. Regular inspections are made of all banana plantations in districts where bunchy top is known to have existed at any time. The rate of inspections depends on the severity of the disease. Bad bunchy top plantations are inspected every three weeks, but in areas which are known to be almost free of the disease three-monthly inspections are the rule.

All bunchy top plants are sprayed with power kerosene as soon as they are discovered. This spraying kills any aphids which may be on the plant, and so stops the rapid spread of the disease. After spraying it is the grower's responsibility to destroy the plant by digging it out and cutting it into small pieces.

Cost of the scheme

Bunchy top control now costs banana growers approximately £28,000 per year. The bunchy top detection staff comprises 46 men working in 13 gangs. Each gang has a motor vehicle for transport. The major costs of control are wages for the detectors and maintenance and running expenses for the vehicles. The cost of bunchy top control in 1950-51 was £1 2s. 10d. per acre of bananas grown in New South Wales. The funds for control are raised by the Banana Growers' Federation Co-op. Ltd., from all banana growers in the State, as a service charge.

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1. Bulletin No. 30, C.S.I.R.O., Melbourne, 1927. ' Investigation of the Bunchy Top Disease of the Banana,' C. J. P. Magee, B.Sc.Agr.
2. ' Bunchy Top Disease Controlled by Co-operative Effort,' H. W. Eastwood, H.D.A.

(*From the Agricultural Gazette of New South Wales*)

WORLD CROPS

OUR NEXT ISSUE will contain, among others, the following articles:—

The Agricultural Possibilities of Morocco, by C. H. Brown.

Changes in the Fertiliser Industry of the U.S.A., by Harry Curtis.

Europe's Timber and Pulp Requirements, by E. L. Hill.

The article by Dr. R. O. Whyte on Legumes in Tropical Agriculture, which was scheduled to appear this month, has been unavoidably held over and will also appear in the next issue.

Agricultural Research in the Belgian Congo

THE Annual Report for 1950 of the INEAC (Institute Nationale pour l'Etude Agronomique du Congo Belge), just issued, is a large volume of nearly 400 pages, covering a wide and diversified field of agronomic study in this vast territory. The principal research centre is at Yangambi (Centre de Recherches de Yangambi) and there are several branch establishments. This is the 17th annual report and 1950 is the first in the Ten-Year Plan for the social and economic development of the Belgian Congo. It therefore marks the beginning of an era of greatly intensified activity. Although reference is made in the introduction to social development, those concerned with the sociological aspects of colonial development—that is to say, more specifically the effect of the impact of Western civilisation on the native—will find little in this report to interest them.

But although there is no reference to guiding principles on native welfare, there are one or two brief paragraphs of an eminently practical nature on the work of the administrative services concerned with native personnel. The total labour force employed in 1950 was 3,539 'units' and shows an increase over preceding years. Food rationing has been established on an improved system; erection of homes and villages for the workers is said to have proceeded normally; increasing attention was given to education both elementary and more advanced; also provision exists for adult education. And what is perhaps of even greater interest and importance, some attention was given to recreation and leisure uses, including various forms of sports, educative entertainment, cinema films, recreative and theatrical soirees, etc. All this is part of the general administrative services which include also a medical branch, and technical services such as workshops, building yards, a parks and gardens department, land surveys, etc.

Mulungu-Tshibinda station, showing surrounding country

Scientific research

The scientific research service comprises botanical, plant physiological, forestry, climatology, and other related sections. Among these forestry and afforestation occupy an important place. Headquarters are at Yangambi, with a branch station at Mayumbe, and 'groups' (groupe forestiere) at Katanga, Ituri, Bas-Congo and Kivu. At the first (headquarters) particular attention has been directed to a study of the different kinds of trees for economic uses, in short, economic forestry, and to extending the arboreta or experimental plantations. At most of the other stations work has proceeded normally on forestal biology, phenology (climate effects), plantations and collections, etc.

The section for agronomic research comprises the following divisions: oil palm, rubber (*Hevea*), coffee and cocoa, general food plants (vivrières) and farm engineering. The crops named are, of course, of great economic value and importance, and are those for which the Belgian Congo offers wide scope for cultivation and improvement.

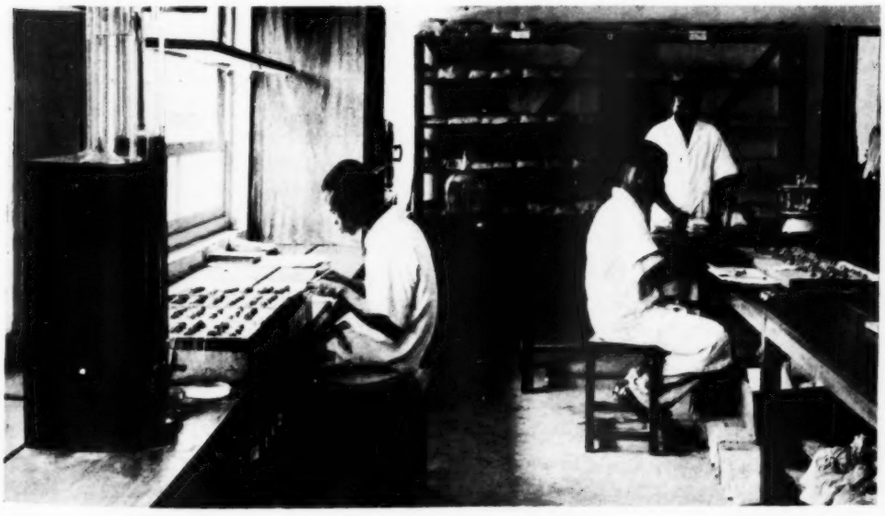
Oil palms

The oil palm experimental plantations at Yangambi cover about 76 hectares, and the number of palms under observation in 1950 was 10,900. This plantation is relatively small compared with the much larger ones at Elisabetha, Binga, Likete, and Mayumba, but its selection work appears to have achieved some highly interesting results, especially with the female lines F_2. Special study continued with 17 palms selected from the most productive lines of the station. Their selection was based on two criteria: relatively short stipule (faible hauteur du stipe) and high yield of oil (presumably of both kinds, palm and palm kernel). During the year 126 cross-fertilisations were made and more than 5,000 plants were pricked out (repiqué) in pots or baskets and some 12,000 in nurseries. Descendants of the second generation were planted out on an area of 32 hectares. No records of oil yields from older trees are given.

Some work was also done on *Elaeis melanococca*; and experimental work on specimens of the ordinary oil palm (*E. guineensis*) from Malaya and French West Africa. In addition to the work at the main station, Yangambi, selection research has also been undertaken at Mayumbe, Elisabetha, Binga and Likete.

Intercalary crops

Intermediate cultivation or interplanting tests at Yangambi have been continued, with tapioca (manioc), maize, rice, bananas and groundnuts as intercalary crops, either singly or in various combinations of two or more. Earlier experience is confirmed and oil palms with such inter-cropping show increased weights of regimes



Congolese assistants at work in one of the Ineac laboratories

(*Left*) **A plantation on the banks of the Congo, established by the Ineac station at Yangambi.** (*Right*) **One of the Ineac stations; this one is at Mulungu-Tshibinda in the Kivu district**

(bunches) up to 20%. Over 7 million seeds were distributed in 1950 of the following strains or crosses: *tenera* x *dura* (1st category) 1.8 million, *tenera* x *dura* (2nd category) 1.2 million, *dura* x *pisifera* 1.9 million, and *dura* illegitimate 2.3 million. Two new seed distribution centres have been established—at Binga and Kondo. The distributed seeds were pre-treated with organo-mercury salts as a fungicide, and experiments to determine the effect of this on seed fertility showed that it had no detrimental action.

Further details of the oil palm experimental stations, with yields of oil, are given in another section (Service des Plantations Experimentales) for the stations at Barumbu, Gazi, and Yangambi. At the first of these oil yields per hectare ranged from 346 to 921 kilos, according to age, etc. The total for 1950 was 2,471 tons of bunches giving 1,593 tons of fruit, 333 tons of palm oil, and 130 tons of palm kernels. The oil acidity ranged from 3.48 to 4.60% free fatty acid. At Gazi the work is mainly with rubber, and with oil palms on a very small scale, namely, 32 hectares of rather old plantations yielding 362 kg. palm oil per hectare. The oil-palm plantations at Yangambi are said in this section to cover 109 ha. (instead of 76 ha. as stated in an earlier section of the Report) and with an additional 565 ha. for the 'Km.5' plantations total 674 ha. The yield in 1950 was 3,570 tons of bunches, or 2,071 tons fruit, yielding 584 tons palm oil and 154 tons palm kernels. Yield of oil per ha. was therefore 866 kilos.

Other sections of the Report relate to rubber, coffee, cocoa, other food crops, cattle rearing, and pasture improvement.

Obviously the work of the Institute is yielding results of high scientific and practical value which are bound to exercise a profound effect on production in many agricultural industries.

W. G. Cass.

Photos: Pp. 69 (top) and 70, Service de l'Information du Congo Belge.

Asian-Pacific Forestry Commission

Seventy-five delegates and observers met in conference in Singapore on December 1-13 to discuss the forestry problems of Asia and the Pacific at the second session of FAO's Far Eastern-Pacific Forestry Commission.

A full agenda was provided, the underlying significance of which was that the well-being of the Asian peoples depends on the well-being of the land and this involves study of the problems of tropical siliviculture and forest management. The delegates reviewed FAO's work in forestry under the Expanded Technical Assistance Programme. Pulp and paper supplies, which are of particular importance in view of FAO's efforts to increase pulp production in the Far East, was one of the items on the agenda. The use of aerial photography for making inventories of tropical forests was another item discussed. Member governments represented on the Commission include Australia, Burma, Cambodia, Ceylon, France, Italy, Indonesia, Japan, Nepal, Netherlands, Portugal, Thailand, U.K., U.S.A. and Vietnam.

Quarantine Officer in New Guinea

Mr. L. J. Dumbleton, plant and animal quarantine officer to the South Pacific Commission, has returned to headquarters at Noumea, it is reported, following visits to Australia and Dutch New Guinea.

The main object of his mission was to make contact with quarantine officers of those territories and in addition to study at first hand their problems of pest and disease control.

'The two most serious pests threatening crops in New Guinea are the giant snail and the rhinoceros beetle,' said Mr. Dumbleton. 'The giant snail, which was introduced by the Japanese during the war as a form of emergency ration for their troops, attacks a wide variety of leaf crops, even young cocoa and teak. It occurs around Kavieng in New Ireland and Rabaul in New Britain but, fortunately, on the mainland it is fairly well contained in a small area near Madang, enclosed on three sides by two rivers and the sea. In Dutch New Guinea it occurs at Manokwari. Poison baits offer the best form of control so far discovered.'

Speaking of the rhinoceros beetle, Mr. Dumbleton said it was causing serious damage to coconut plantations in certain areas, mainly in New Britain and New Ireland. In an attempt to control it, the authorities were introducing a parasite wasp from Zanzibar.

During a recent campaign against cotton jassid in the Sudan 10 aircraft and 25 spraying machines were used by Pest Control to treat nearly 300,000 acres

INDUSTRY'S CONTRIBUTION TO AGRICULTURAL RESEARCH—XIV

Part II

Pest Control Ltd.—Overseas

W. E. RIPPER, Ph.D., F.R.E.S.

Managing Director, Pest Control Ltd.

This second part of Dr. Ripper's article deals with aspects of the research work carried out by his organisation in overseas territories.

AFRICA is one of the most important development areas of the world and it is held back, *inter alia*, by gigantic pest problems; it is thus an important field for pest control research and large-scale operations. One of the largest of the continents, Africa exhibits every variety of climate and ecological environment, ranging from the Mediterranean conditions of Egypt or French North Africa to the temperate zone at the Cape. It possesses rain forest, desert, high temperate plateaux, veld, tropical jungle, and summer and winter rainfall areas suitable for cereal growing. It harbours pests on every kind of crop, often continuously throughout the year.

Every kind of agriculture is practised from primitive shifting cultivation to scientific mixed farming. There are monocultures of plantation crops like cotton, sisal or tobacco; there is irrigation cultivation of cotton and rice; there are mechanised crop production schemes, both Government-run and privately operated, and European and native farming exist side by side.

Africa is also of great political importance to Britain. We have a special responsibility to raise standards of living—which begins with the increase in food output and improvement of nutrition—if we are to make a success of the Commonwealth ideal in these diverse territories.

Although a great deal of research work on the control of pests is carried out by the specialist officers of the agricultural departments of the various African governments, growers' associations and also by research expeditions sponsored by the Colonial Office, this is still a comparatively small effort, and as yet little is known of many very important pests. A great deal of further research work must be done before the control of all the major pests can become a major operation.

African network

Pest Control Ltd., through a network of subsidiary companies and research expeditions, now operates in almost every part of British Africa. The specialised experience gained in chemical control in this country has important applications in Africa, and Pest Control has been able to make a contribution to pest control research in African territories. And it is often possible to make use of knowledge gained in one African territory in another. The stalk borer problem is common to all maize- and sorghum-growing districts, for example, but the species and their behaviour vary.

Pest Control (Sudan) Ltd. is principally concerned with protecting cotton under varied conditions of irrigation and rain-grown cultivation, and the control of weeds in millet. Pest Control (East Africa) Ltd. increasingly tackles weed and insect problems in Kenya and has also made a start in Tanganyika. Pest Control (Central Africa) Ltd. is strategically located in an area which, according to present proposals, will ultimately become a self-governing federation

of the Rhodesias and Nyasaland. Pest Control and Crop Protection (South Africa) Ltd. operates in most parts of the Union. In West Africa we have, in the Gold Coast, a research team which is investigating the Swollen Shoot problem. All these organisations keep in close touch with the overseas research department at headquarters through the Overseas Research Co-ordinator, Mr. O. W. Snow, O.B.E.

Supplementing government research

We supply, in the different conditions of Africa, services very similar to those we supply in Britain, as described in the previous article; but particular emphasis is placed on our ability to undertake research projects for particular areas, at the request either of Governments or growers' associations. Throughout Africa the need for research into particular pests or weed problems is urgent. The continent is being rapidly developed, and ecological conditions are being changed at a comparable pace. Pest outbreaks are inevitable, and modern transport spreads pests once confined to particular localities. The most modern facilities are required to tackle problems which seem insuperable by older methods, while Government institutions are overwhelmed with numerous problems quite apart from routine work and are often understaffed. Some problems, again, can hardly await the establishment, by a particular industry, of a research institute. In these circumstances, Pest Control Ltd. has been used as a sort of mobile reserve to be sent to threatened sectors, to supplement work already being done, or to bring special knowledge to bear on intractable problems. It should cause no surprise that, at a time when the consulting engineer is hard at work all over Africa, the mechanisation expert is changing age-old concepts of agriculture, and the industrialist is expanding the demand for crops, the consulting entomologist should have tasks to fulfil.

Cotton pests in the Sudan

Our research for the Sudan Government is conducted in various centres and supplements the excellent work of the research division of the Ministry of Agriculture on the control of the four species of bollworm, *viz.* the pink bollworm (*Platyedra gossypiella* Sound.), the spiny bollworm (*Earies insulana* Boisd.), the Sudan bollworm (*Diparopsis castanea* Hamp.), and the American bollworm (*Heliothis armigera* Hbn.). These insects cause heavy damage to the bolls into which they tunnel. In the Gash they cause damage estimated at £900,000 a year at 1951 prices. They occur throughout Africa, and are pests of many crops beside cotton. They present a complex picture, for their life cycles vary and their mode of attack, though similar, produces different forms of damage. A single simple control has yet to be found, and perhaps will elude us for a considerable period. But we have made some useful advances in control measures. It has long been known that pink bollworm control depends on seed disinfection. Control of spiny bollworm is now reduced to the problem of destroying by 'hormone' weedkillers the host plants on which the pest overwinters. Sudan or red bollworm can now be destroyed by an insecticide with systemic action, applied at the time of the first egg-laying by moths emerging from the first diapause pupae. American bollworms present great difficulties, for while they succumb easily to DDT, unselective insecticides such as benzene hexachloride and DDT may upset the balance of predators and lead to serious outbreaks of spiny bollworm. Research is therefore being pressed forward.

Our research workers have also made a contribution to the understanding of the problem of the jassid (*Empoasca lybica* de Berg) on Sudan cotton. In collaboration with the research division of the Sudan Ministry of Agriculture and Forestry, experiments were made in 1944 to determine which of the insecticides—DDT, BHC and copper compounds—would give economic results, and found that DDT emulsion gave almost 100% kills. Pest Control (Sudan) Ltd. has since refined the method of application and developed large-scale spraying techniques; every year it has sprayed a larger acreage, and this year expects to spray 265,000 acres. It has now been shown that the increased yield, due to spraying in 1950-51, was over three-quarters of a kantar per feddan (91 lb.), and the overall increase in crop amounts to nearly 40%. In most areas the cost of spraying was repaid over 20 times. This was made possible by a major feat of organisation in a spraying season, which lasts for only six weeks. Close control must be kept on progress, and headquarters keeps in touch by frequent visits of experts by ground transport and aircraft. Very accurate adjustments of gear and dosages are essential in flying operations if perfect coverage is to be obtained. Very slight errors would be penalised by a rapid come-back on the part of the pest in unsprayed patches, for it has been estimated that the jassid population in a given area can increase by 1,500% in six weeks.

On a Kenya coffee plantation a Pest Control sprayer treats coffee against blight and leaf rust

Raising the grade and yield of tobacco

The importance of cotton as a cash crop to many African territories is great; but tobacco is also a staple in many others. Africa is an important source of non-dollar tobacco, and in Southern Rhodesia it is the main export crop. Our Rhodesian company began work on such pests as nematodes and other soil insects in tobacco and potatoes in 1946; in 1948 the Rhodesian Government and the Rhodesian Tobacco Growers' Association called in the Pest Control Organisation to provide a four-year scheme to initiate research into urgent pest problems in tobacco while the Research Board was recruiting its own

The leader of a Pest Control research team working in Kenya on coffee pests discovered that the application of systemic insecticides to the tree trunk is more effective than soil treatment

staff and creating its own facilities. Among the pests studied by the team were tobacco aphis, budworm, white flies, wireworms, white grubs, cutworms, weevils and eelworms.

The tobacco scheme is a good example of the service which our combined research and contract departments are able to give. We were able to demonstrate that eelworms could be controlled in tobacco lands by injection of Nematox (ethylene dibromide 85%) or dichlorpropane dichlorpropene mixture. Successful experiments were also made with fumigation under sealed plastic covers of tobacco seedlings by methyl bromide for the simultaneous elimination of eelworm and weed seeds; 100% control of weeds and nearly 100% control of eelworm were recorded.

For wireworms (*Trachynotus* spp.), cutworms (*Euxoa segetum* Schiff), and white grubs (*Eulepida mashona*) applications of 0.1% Chlordane poured as an emulsion in a shallow depression round each plant have been found to afford complete protection, while both Chlordane and Nematox have enabled farmers to deal with the cricket pest. Two sucking insects, tobacco aphis (*Myzus persicae*) and white flies (*Aleyrodidae*), depress yields of leaf and transmit virus infections (rosette and leaf curl) which may be even more serious inasmuch as they lower the grade of the tobacco. The non-selective partially systemic insecticide Parathion has been used by our organisation in Rhodesia with great success against these pests, but we place more confidence for the future in the promising results obtained from the use of Pestox 3, which is selective as well as systemic (as described in the preceding article). By skilled spraying of Pestox 3 it should be possible to prevent rosette and leaf curl on tobacco plantations.

The tobacco planter is also severely affected by the fungus diseases of the tobacco plant, as well as the virus disease mosaic, as these directly lower the grade of his leaf. In the case of mosaic, routine decontamination of pickers' hands and clothing has now been shown to give complete control. In the case of such fungus and bacterial diseases as wildfire, angular spot, white mould and damping off, promising preliminary results have been achieved with systemic fungicides, but it will be some time before this development can be evaluated. Systemic fungicides would solve an immense range of problems in plant pathology, but their development is for obvious reasons a problem of great difficulty.

Among other problems, the phytotoxicity of a number of insecticides was worked out by members of our team, D. G. Ashby, G. H. Bunzli, and W. W. G. Buttiker, while C. J. Shepherd investigated the effect of insecticides on the microfauna and microflora of the soil, thus enabling us to determine the limit of applications of insecticides designed to kill soil insects without depressing fertility.

Another soil insect which causes considerable damage to an important plantation crop is the sisal weevil (*Scyphophorus* Gyll). Even where yields are not greatly affected, stands are rendered irregular by the depredations of this insect; in coastal districts of Tanganyika up to 30% of transplants are lost as the result of its tunnelling in the boles. Direct damage to fibre and leaf has been estimated at £30,000 a year. Pest Control Ltd. was called in by the Sisal Growers' Association to investigate the life-history and possible control of this insect, and a comprehensive programme of research, conducted at the Sisal Research Station near Tanga, has now reached conclusion. Subject to economic considerations, it has now been found possible to sterilise boles with chlordane and other chemicals, and to protect transplants from weevil attack.

South African fruit research

In South Africa an investigation by officials of the Department of Agriculture estimated losses to crops from major insect pests and virus diseases at about £15 million a year; the tonnages of food lost would probably feed between 1½ and 2 million people. Pest Control and Crop Protection (S.A.) Ltd. is applying many of the methods developed by our organisation to reduce these losses. The struggle against codling moth in South Africa provides an object lesson. This insect had developed such a degree of immunity to lead arsenate that growers were having to apply up to 20 sprays a year. Even with weekly sprayings, 40% of the crop was lost and the trees were damaged, often seriously, by the phytotoxicity of the chemical. The introduction of fixed nicotine sprays, with which we had experimented in Britain, reduced sprayings to nine for apples and 14 for pears. In 1946 we worked out a control by means of DDT emulsion in conjunction with the Western Province Fruit Research Station at Stellenbosch, and tested the performance of fully automatic oscillating sprayers in place of hand lances. We were able to reduce sprayings to three per year by careful timing. Unfortunately DDT, while giving control of codling moth, has so reduced the population of red spider predators that it has now become necessary to add parathion sprays thereto. We continue to work upon a solution to this problem.

Mealy bugs in Africa

Various species of mealy bugs, both with and without attendant ants, are serious pests on many crops in Africa. One mealy bug attacks South African vines, another East African coffee, while a third transmits the Swollen Shoot virus to West African cocoa. We have experimented with many insecticides against the mealy bug, particularly with systemics. Chemotherapy appears to offer the ideal solution by combining chemical and bio-

logical controls in the manner summarised in the previous article. But it is not necessarily an easy solution to apply in African conditions. We are still examining the possibilities of using systemics against mealy bugs on vines, as present control methods based on destroying the attendant ants are imperfect and unreliable, and growers prefer to use indiscriminate insecticides which kill beneficial insects along with the pest. This in turn upsets the ecological balance, so that snout beetles, for example, tend in some areas to give increasing trouble.

East African coffee

In Kenya we have undertaken, at the request of the Kenya Coffee Board, a full-scale research into means of controlling the coffee mealy bug (*Pseudococcus kenyae*) by reinforcing the effects of the biological control which is exerted, but sometimes ineffectively by the parasitic wasp *Anagyrus kivuensis*. Here again systemic insecticides would resolve our difficulties. This work was supplementary to the researches of Dr. Le Pelley and Dr. Melville, who have made so great a contribution to biological control of coffee pests in East Africa. Dr. Melville indeed saved the coffee industry by the introduction of a parasite of the mealy bug, but soon found that an ant tends the coffee mealy bug and protects it against parasites and predators. Once the ant is eliminated the natural enemies of the mealy bug find it easier to control the mealy bug. Field and laboratory experiments were satisfactory with the new methods worked out by the research team, and it will now be necessary to carry out this on a large scale as a contract service.

The Swollen Shoot problem

That such difficulties can, nevertheless, be overcome in apparently unpropitious circumstances is shown in the results achieved by Pest Control's research team, under the direction of Dr. Hanna, working on swollen shoot disease of cocoa in the Gold Coast. The work of this team goes back to a suggestion made by one of the scientists delegated to examine the problem by the United Nations at the request of the Gold Coast Government. This team has worked first under contract and in collaboration with the West African Cocoa Research Institute since 1950, with fruitful results. It is now well known that several species of mealy bugs, but more especially *Pseudococcus njalensis*, transmit the strains of swollen shoot virus, which kill the cocoa tree in from two to four years, depending on the virulence of the strain. A great industry is thus in peril of destruction, for the disease is spreading at the rate of 18 million trees a year.

Under experimental conditions it was shown that the systemic insecticide Hanane gives a high kill of mealy bugs, but the cocoa mealy bug presented a difficult problem: for the damage is done not only by comparatively minor populations of the insect but the insect is well protected by the cartons or tents built over it by the *Crematogaster* ant, which effectively defends it from predators, parasites and insecticidal sprays. A systemic insecticide thus provides the ideal solution to this problem, for it enables one to create a mealy-bug toxic—rings of trees treated with Hanane around any given source of infection, whether this be a single tree or, as is most usual, an area of trees. If the infected trees are also treated no mealy bugs can issue to spread the disease. With the cutting out of all infected trees as they exhibit symptoms further transmission of the virus can be stopped, since the sources of infection disappear.

Treatment

There are, of course, complications to this simplified picture of the problem. From the organisational point of view, the long period of incubation of the disease in the tree is a difficulty; it is hard to explain the position to African farmers, and it involves a succession of treatments; more immediately, it lengthens the time required for the assessment of results from the large-scale field trials now in progress.

But so many apparently insuperable difficulties have already been overcome that there is hope that this one, too, can be surmounted. The African farmers have been much heartened by the fact that a combination of the Hanane treatment with cutting out might completely stop swollen shoot disease in the not too distant future, and therefore have enthusiastically accepted the Government's recommencement of the cutting out campaign which is now making good progress. A lot of field experiments have still to be done, but it is hoped that we shall soon be in a position to accelerate and improve the cutting out campaign by a combination with the Hanane treatment.

Growing spray practice

Except in South Africa, large-scale application of modern pest control measures is completely new. In Kenya, for instance, we have undertaken the spraying of large acreages of coffee with copper compounds to arrest the spread of the fungus diseases, *Hemileia vastatrix* and *Colletotrichium coffeanum*, which between them cause heavy losses through premature leaf fall. To do this it has been necessary to set up an organisation, combining research, expert technical assistance, and a park of equipment and spares. It has also been necessary to design a sprayer to suit the crop. We are indeed increasingly being asked to advise on methods of application in new or difficult conditions; an example was a recent technical mission to Ceylon to report to the Tea Research Institute on methods of applying fungicides to tea to prevent blister blight.

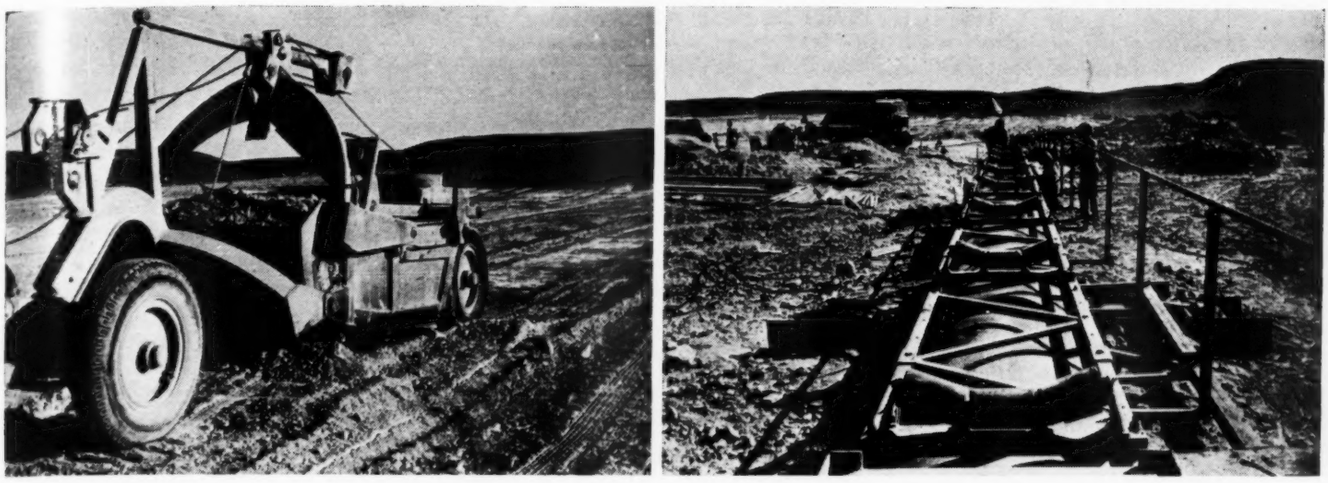
Importance of scrub clearance

Now that the general principle of pest control has been established, the practice spreads from crop to crop. It is remarkable, for example, how farmers in East and South Africa now accept the importance of weed control, and are anxious to have modern weedkillers tested under local conditions against indigenous and introduced weeds. Improvement of pastures, particularly by scrub clearance, is now an important aspect of the policy of some governments in Africa, because of the need to find more cultivable land on which to settle growing populations, and to clear tsetse-infected bush to enable them to carry larger and better herds. Large-scale methods of applying TCA or 2,4 5-T may bring land into use which would have been regarded as unreclaimable under former conditions.

The future

But these measures must be economic. Ideal solutions which cost more than the crop is worth are of no practical value. It is gratifying that the Colonial Office and the colonial and other governments are calling on chemical industry to solve the practical problems. We believe that we can apply in Africa the economic lessons learned in nearly 14 years of research and commercial crop spraying in this country. This is the challenge. Can we bring to Africa the science of plant health as the necessary complement to the spread in Africa of modern medical science, which alleviates suffering immediately but by increasing populations everywhere sets us the task of increasing food production and alleviating malnutrition to keep them alive? To this venture, by the export of technology for the development of new resources, human and material, and hence for the strengthening of Western culture, the Pest Control Group has made and is making its contribution.

ISRAEL PLANS SELF-SUFFICIENCY IN FERTILISERS



The Negev phosphate rock deposits. (*Left*) **removing the top layer to uncover phosphate rock.** (*Right*) **conveyor belt under construction**

SCHEDULED for completion in 1954, a new £12 million fertiliser plant is being built at Haifa by Fertilisers & Chemicals Ltd., reports our contemporary *Chemical and Process Engineering*. It will produce all Israel's requirements of fertilisers and provide local industry with important heavy chemicals.

Output

The individual units are being designed to produce 150,000 tons single superphosphate, 50,000 tons ammonium sulphate, 45,000 tons ammonium phosphate, 15,000 tons potassium sulphate, 8,000 tons di-calcium phosphate and 7,500 tons ammonium nitrate per annum. Actual output will, however, be varied to meet market requirements.

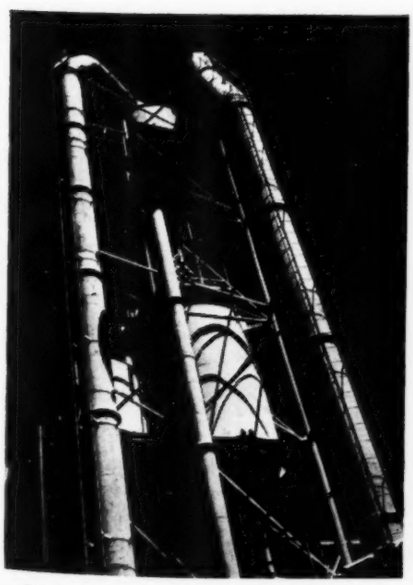
When operating to designed capacity the plant will require annually 14,000 tons ammonia, 85,000 tons sulphuric acid, 25,000 tons phosphoric acid and 14,000 tons nitric acid, all of which will be produced on the spot.

The main raw materials will be obtained from local sources. Proven deposits at the Negev quarries now being worked contain 10 million tons of phosphate rock and estimated reserves amount to 100 million tons. An existing superphosphate plant has operated since 1951 using only local rock. Potash will be obtained from the Dead Sea. Waste gases will be used from the British-owned oil refineries near the fertiliser plant. Pyrites will be imported, there being adequate supplies in Greece and Cyprus.

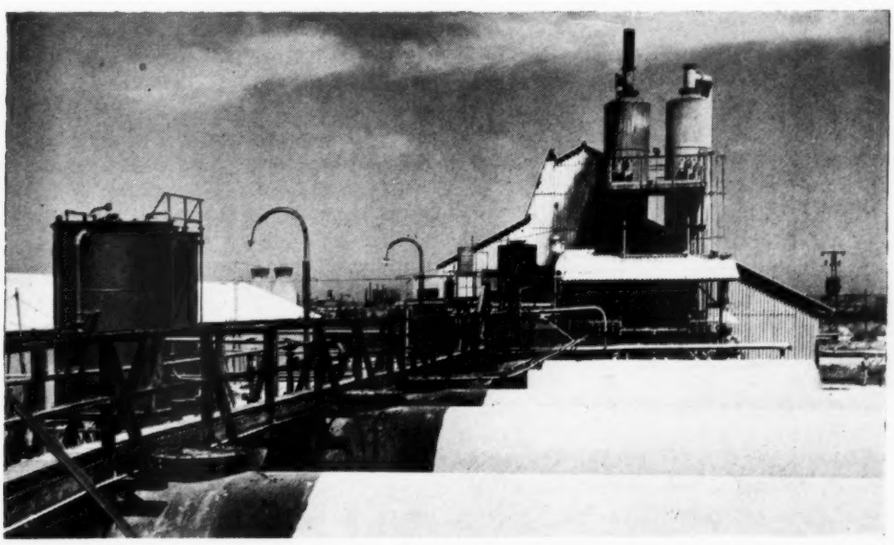
Requirements

The Israeli Ministry of Agriculture estimated local fertiliser requirements for 1952 at 100,000 tons single superphosphate, 35,000 tons ammonium sulphate and 10,000 tons nitrates. Requirements are expected to increase by 15% per annum during the next five years.

This project forms part of the general industrialisation of Israel and the heavy chemicals produced and not used for fertilisers will find a ready home market.



Part of the superphosphate plant



The sulphuric acid plant; an additional unit is now under construction. The Haifa oil refinery installations and cooling towers can be seen in the background

RESEARCH DEVELOPMENTS

An Antihormone – Maleic Hydrazide

AMONG the newest chemicals is Maleic Hydrazide which is currently being developed by the U.S. Rubber Company through one of its subsidiary concerns. Hydrazide is a useful herbicide, particularly for grasses and deep-rooted weeds: but as well, hydrazide is a compound of a novel kind; it is a growth inhibitor; and when all the technical problems of its application have been solved this substance may be a valuable adjunct to crop production control.

To cite a few examples. Green keepers yearly foot a heavy bill for grass mowing and would welcome a way to curtail this expense; in one trial maleic hydrazide treatment reduced summer mowings from 19 operations to two. Fruit, vegetable and flower merchants lose profits when produce spoils in store and they may find that hydrazide will help them cut these losses. Bulky root vegetables and beets when clamped through the winter lose appearance, quality and nutrient value. Tests now reveal that hydrazide-treated roots store better and make fewer sprouts than the untreated roots. Seed potato growers may find profits rise because maleic hydrazide will give them more small tubers per plant. Experiments have demonstrated that hydrazide will do all these things, and much more besides.

Inside the plant hydrazide is an *antihormone* which blocks the action of natural growth substances (even 2:4:D activity is antagonised) and also reduces the rate of plant tissue respiration. On to the first set of hormones all plant development is geared, while most of the plant's general activity depends upon the respiratory processes. Thus while synthetic hormone preparations boost growth and respiration, maleic hydrazide by contrast, until its effects wear off, 'freezes' the plant at the current state of development.

Some effects

Although each species has its own level of susceptibility, maleic hydrazide is effective for both broad and narrow-leaved plants. Young plants are more acutely affected than old plants by it, although old plants show response at and near the growing points. Hydrazide-affected plants cease to grow for periods, depending upon the dose applied; there is a slight thickening of leaves and green stems, flower and leaf buds are delayed or fail to open. Internally the poison induces partial breakdown of conductive tissue within the stem, so that while water is still free to ascend, sugars and starches generally do not descend. Accordingly, there are many records of high levels of sugars within treated leaves; some of the sugar is converted to pigments and tests indicate that preharvest spraying of apples with hydrazide results in 'rosier' fruits: while on the score of sugar content of treated leaves, the judicious use of hydrazide may enable growers to market vegetables of a more nutritious kind.

Maleic hydrazide's ability to check respiratory processes in fruits probably accounts for its property of being able to check over-ripening. Hydrazide-treated apples stored better and remained firmer than untreated fruits; indeed, hydrazide was satisfactory in offsetting the accelerated ripening of apples which had been given a hormone 'preharvest antidrop' spray. Similarly, a spray application of hydrazide to the foliage of potatoes before lifting enhanced the keeping qualities of this crop; and not only did the chemical stop the potatoes sprouting but the treated tubers retained more of their original starch. Up to 5 lb. hydrazide, in 100 gal. of spray wash, applied to maturing sugar beets raised by as much as 10% the sugar content of the beets. Treated beets stored cooler and lost less weight than untreated roots: indeed, in one trial treated roots lost 1% of sugar compared with 13% from untreated lots. Similar improvements in keeping quality have been found to follow hydrazide application to many kinds of root vegetables.

Leafy vegetables, too, are slowed during growth and when it was put on a fortnight before harvest the new chemical checked bolting, though in another trial hydrazide induced some bolting. Hydrazide seems to check heart rotting in treated lettuce, and it was observed that the duration of the harvesting period was lengthened: a result of obvious importance to growers. Indeed, there seems every reason to believe that treated leaf vegetables will travel better and keep firmer in the shops.

If maleic hydrazide maintains this early promise, the shipping of vegetable produce might become a simpler and less expensive affair than it now is.

Weed growth control

Weed controller, rather than weedkiller, might be an appropriate description of the action of hydrazide upon noxious plants, because large and possibly uneconomic doses may be required for complete weed eradication. Thus while 3 lb. of hydrazide per acre satisfactorily checked wild onion, 12 lb. did not eradicate it and left one bulb per sq. ft. as a bridgehead to re-establish an infestation. The new chemical affects broad and narrow leaf weeds and is considerably more effective, while the plants are making fresh growth; or when, as in the case of annuals, the plants are still a few inches tall. Thus 2 lb. per acre was enough to kill young Johnson grass—*Sorghum* sp.—but 30 lb. only suspended growth without eradication of the well-established grass. Generally, the growth suppressive effect varies with the dose applied, a feature well marked in the case of attempts to control Quack grass—*Agropyron repens*. Growth of this grass was suspended for a month by applying 3 lb. per acre, though 30 lb. per acre did not wholly destroy the weed.

Grass suppressive

As a suppressive for unwanted grasses maleic hydrazide has done fairly well: 1 to 8 lb. per acre checked orchard grasses through a whole summer and thus conserved valuable soil moisture. Lawn grasses, too, required fewer mowings after hydrazide had been applied in the spring; marked success also attended the use of 2 lb. hydrazide on grasses fringing roadways. The chemical applied in spring was followed up by two mowings and checked all summer growth; comparison plots needed 19 mowings, while the same control without mowings, or when hydrazide was used later in the summer, needed 4 lb. hydrazide per acre.

The growth of a *Pyracantha* hedge was retarded and treated sections needed fewer trimmings than unsprayed parts, to keep the hedge in good shape all the summer. Tobacco plants normally needing topping were sprayed with hydrazide; there was suppression of flowering and sucker formation without loss of yield or leaf quality.

Possible drawbacks

It is on the score of human toxicity that hydrazide might become unusable, especially where it is used to check ripening losses or sprouting of vegetables. Current tests have demonstrated that it has a very low toxicity to rats, dogs or cows which were fed single large doses or chronic repeated small doses for as long as 11 weeks. In treated animals no untoward pathological signs were found after autopsy, and microscopic examination of tissues gave no grounds for doubting the safety of hydrazide. On the other hand, it is known

that the new compound may cause nuclear abnormality (this has been established by plant studies at the John Innes Institute), and it accordingly seems not inconceivable that maleic hydrazide might cause cancer in persons who eat hydrazide-treated foodstuffs. How great is this risk is not entirely clear, but it seems unwise to discard completely so potentially valuable a chemical except on the most convincing of evidence. It is difficult to interpret experimentally produced results on animals, in exact terms of human well being, while under laboratory conditions it is impossible exactly to reproduce toxic deposits on foodstuffs so that laboratory and field derived deposits are identical in their action.

On the other hand, it would be equally unwise to ignore instances where the chemical is reported to have caused undesirable results.

ALAN GOODMAN.

Literature Summary prepared and issued by the Nagatuck Chemical Division of the U.S. Rubber Co.

New Locust Theory

Dr. Mohammad Shabbar, a meteorologist in the Pakistan Meteorological Department, who has been verifying and testing the new theory of locust flights advocated by the British expert, Dr. R. C. Rainey, has found that the movement of locust swarms over the Pakistan-Indian sub-continent could be forecast with a reasonable degree of confidence at least one week ahead and measures could be adopted to fight the menace.

An illustrated thesis will be placed before the Pakistan Science Congress in February.

AUSTRALIAN DEVELOPMENTS

Flax Breeding—Scrub Clearance—Rice Prospects—Cotton Trade

Our Australian correspondent writes as follows:—

A new flax variety developed in Western Australia has been accepted for registration and released for commercial cultivation. Named Boyup, it is the result of cross-breeding and selection work carried out by the plant-breeding section of the West Australian Department of Agriculture over several years. Boyup is a blue-flowered early-maturing variety, the result of a natural cross between the locally-selected Wada and the imported Concurrent. Slightly taller than Wada and possessing a stronger straw, the new variety is more rust-resisting than the other varieties and gives excellent yields of flax fibre. Research work was carried out at the Avonda'e Research Station and the flax was finally tested at Boyup Brook, the centre of the West Australian flax-growing industry.

* * *

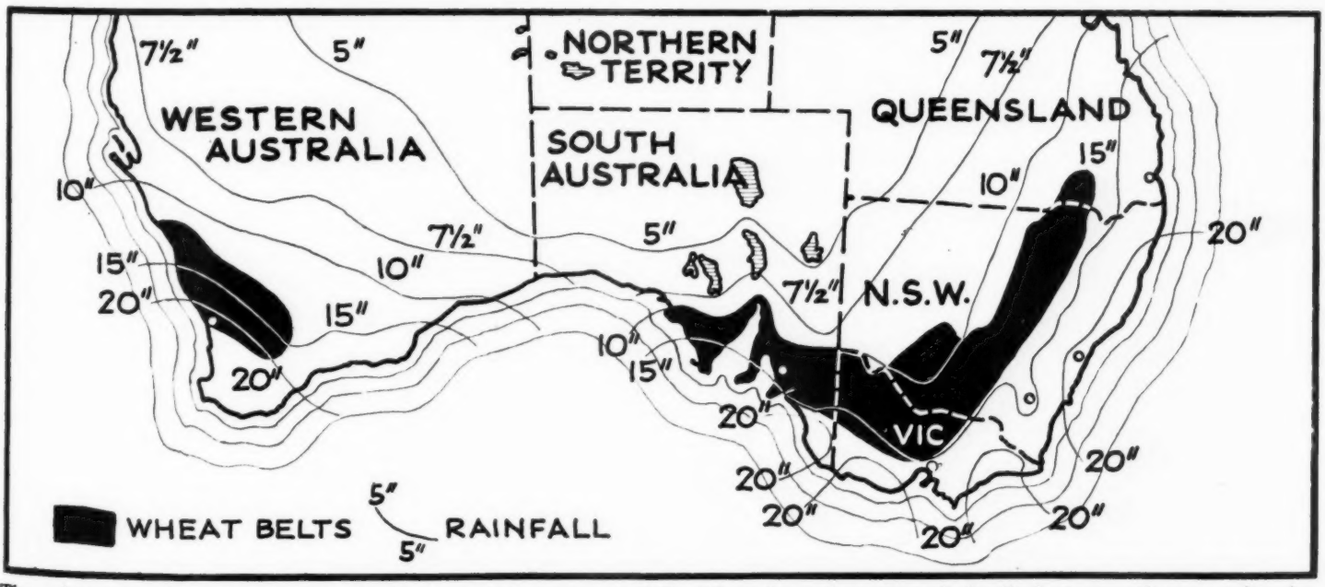
Further success in the economic cultivation of poor heath country in the 90-mile Plain of South Australia is reported by the C.S.I.R.O. The economic cropping of grain legumes in this area marks a further vital stage in the successful attempts to adapt the Coonaplyn Downs for food production. The area selected for the trial carried mallee and broom brush scrub and was cleared and prepared for seeding by the usual methods. Deficiencies in phosphorus, zinc, and copper were countered by applications of 1½ cwt. of superphosphate per acre, 7 lb. of zinc sulphate per acre, and 7 lb. of copper sulphate per acre. Many of the species tested grew well, and it is proposed to extend the investigation to additional varieties.

* * *

World rice authority W. Poggendorf believes that rice growing in the Northern Territory will eventually overshadow the pastoral industry and uranium mining to become that State's biggest industry. 'Rice growing could be a big thing,' he said. 'In this type of country, development must be on a large scale.' Mr. Poggendorf, chief of the division of plant industry in the New South Wales Department of Agriculture, made the statement shortly after he had completed a two-day inspection of the Humpty Doo project and another rice-growing project about 60 miles from Darwin. He also inspected another area where imported rice will be grown in quarantine. 'My tip,' he said, 'is that rice growing will become a big thing.'

* * *

Commonwealth Government intervention is being sought because of a refusal by Australian spinners to buy more than half of Queensland's 1952 cotton crop. Requests for urgent help have been made to the Minister for Trade and Customs (Senator O'Sullivan). Of the State's 1,500 bales of cotton, only 700 have been sold. Senator O'Sullivan has promised to take the matter up with the Australian Cotton Textile Manufacturers' Association in an endeavour to sell all the Queensland crop, which represents less than 2% of Australia's total cotton consumption.



The wheat-growing areas of Australia in relation to rainfall. Note how the wheat belts lie between the 10 and 15-in. rainfall isohyets, particularly in the east

ANNUAL REPORT

The Work of FAO for the Year 1951-52

THE Annual Report of the Director-General of FAO for the year 1951-52 has recently appeared. In it the Director-General, Mr. Norris E. Dodd, reviews the progress made and points out some of the highlights, indicating the salient features of the work at present in hand and probable future developments.

In so doing he prefaces his review by expressing the belief that during the past year the organisation has made more progress than in the whole of the five previous years of its existence.

Advances made

In a brief foreword he sets out the nine principal directions in which material advances have been made during the year, each of which is considered in a separate chapter of the report.

The first point is the widened interest in the food and population problem which is mobilising thought and effort on an unprecedented scale. Second, is the greatly enlarged programme of technical assistance for economic development. This movement, it is pointed out, has resulted in FAO's having over 400 technicians actually working on field assignments by August 1952, covering every aspect of the Organisation's work in agriculture, fisheries, forestry, economics and nutrition. Moreover, many of these workers are themselves occupied in training local technicians in the actual countries themselves, so that the running of training centres has now become a major part of the work. These centres cover such widely diverse subjects as agricultural co-operatives (in the Near East), agricultural statistics (Latin American and Asia), various aspects of fisheries and forestry work in Asia and Latin America, and nutrition and extension work. As a result, too, of the technical assistance drive, increasing numbers of fellowships are being awarded to enable technicians from the less developed countries to train and get experience overseas.

Regional programmes

Emphasis is being laid on large-scale regional programmes. These may be concerned with pests of crops, such as the great desert locust control programme which has been operating for a full year now in the Middle East; with increasing crop yields, as in the case of the rice, wheat and maize breeding schemes in various parts of the world; or with animal diseases, such as rinderpest in the Far East and foot-and-mouth disease in Europe.

With regard to long-term planning toward definite objectives, Mr. Dodd regards the present ' as a central generative phase of the whole process of achieving greater abundance,' because ' realistic programmes for production and trade must include such factors as price and credit policies, agricultural investment, extension services, land tenure policies, cooperative organisation.' Work on all of these fundamental aspects of agriculture is now in hand, an example quoted being that of agrarian reform. Problems of land tenure, in fact, are some of the most difficult to tackle in even a highly developed country, but here, too, FAO is now prepared to give technical help to member governments, at their request, in preparing and carrying out action programmes.

General development programmes, many of them covering a wide range of carefully integrated operations, have attracted much attention during the past year and will continue to do so. Some idea of the extent of this work is gathered from the fact that no less than 50 forestry experts are now distributed over seven of FAO's member countries, ranging from Yugoslavia to Mexico and Thailand.

Increased attention, too, is being paid to work in home economics, ' in a sense, the cornerstone of the FAO structure.' Apart from the regional and national development projects, there are always those of world-wide importance, and to these the 1951 Conference of FAO, which inspired much of the work here reported, paid particular attention. Bodies such as the Committee on Commodity Problems are as world wide as possible in their scope and their reviews of the situation in the complete range of commodities are an essential part of FAO's service. Another project of a different kind is the International Plant Protection Convention, signed by 39 nations and now coming into effective operation. A world review of the pulp and paper situation is another of these key problems now in hand.

In a final short section, Mr. Dodd considers frankly some of FAO's difficulties, financial as well as practical. The 1951 Conference requested new operations in some 20 different fields, at an estimated cost of $1,000,000. The completion of these and other operations is made the more difficult because the FAO budget is not only smaller than that of other major UN agencies, but is also less flexible. Yet, asks Mr. Dodd, ' surely the work of increasing food production and improving agriculture is not less important ? '

Search for Rust Resistance

The Indian Agricultural Research Institute has discovered improved varieties of wheat and barley which resist attacks by black rust, reports the Commerce Department of the High Commission of India.

Experiments are being carried on by the Institute to find improved species of wheat which would combine resistance to all the three types of rusts, *viz.* black, brown and yellow. It is expected that better species of wheat may be discovered to resist the attacks of these rusts on a regional basis. At the moment rust-resisting wheats for Bombay and Madhya Pradesh have been discovered.

Dr. R. S. Vasudeva, Head of the Division of Mycology and Plant Pathology, said that it had also been found by experiment that, except in cases of acute shrivelling, grain obtained from rust-affected plants could be used for sowing purposes. ' Still our biggest job remains. We have to find wheat which will resist rust attacks in Punjab, the main wheat-producing area of the country, where all the three varieties of rust attack the wheat plant,' he said.

Royal Agricultural Society

The Earl of Derby, M.C., of Knowsley, Prescot, Lancashire, was elected President of the Royal Agricultural Society of England for the ensuing year at the Society's annual general meeting held in London recently.

The retiring President, Earl Fortescue, was thanked by Lieut.-Colonel H. J. Cator for the way he had conducted the Society's affairs during a difficult year. Replying, Lord Fortesue said he was sorry that in spite of the record amount of £14,000 raised for the Local Fund, the Newton Abbot Show would disclose an estimated loss of over £9,000, which he thought was largely due to the effects of foot-and-mouth disease and the resulting absence of cloven-hoofed stock.

The annual report for 1951 shows that Her Majesty The Queen has been petitioned to grant a new Supplemental Charter for the Society.

The ordinary income and expenditure account for 1951 showed an excess of income over expenditure of £1,668. The accounts for the Royal Show at Cambridge in 1951 showed a surplus of £2,124.

CONFERENCES AND MEETINGS

The November 1952 Meeting of the Council of FAO

THE 16th session of the Council of FAO opened on November 17 confronted by the fact that the battle for food has not yet been won. As Council chairman, Josue de Castro opened the session and said that a large proportion of the people of the world was still underfed and it was barely possible for food production to keep pace with the increasing growth of population. Although food production records over the past 10 years showed increases, most of them had been in North America. In the Far East, where half of the world's population lived, food supplies *per capita* were less than before the war.

Director-General Norris E. Dodd said that it was a situation calling for unrelenting vigilance and a keen need to be realistic. The concrete achievements of FAO in the international effort to increase food production had been accompanied by increased activities and responsibilities.

Australian delegate F. W. Bulcock deplored the restrictions imposed on FAO by the lack of adequate funds. He did not see how a total staff of 1,188 people at headquarters and in the field could possibly accomplish the task of dealing with the world food situation. It was necessary, he added, to devise a system of priorities and to concentrate activities on the most vital fronts in the battle against hunger.

In their review of the world food situation, the Council members returned to the point that food production, particularly in the Far East, must be raised and raised quickly. Canadian spokesman Dr. G. H. S. Barton said that present production figures offered only very slight grounds for encouragement. He pointed out that a favourable increase in 1952 in wheat production was due largely to favourable weather. In future years, he said, there might well be shortages due to drought in the North American producing areas. There was still no increase of food, nor any prospect of increase, in the needy areas of the world. It was emphasised that the consequence of medical advances against disease had been an enormous and largely unexpected rise in world population and it was difficult to expect a sufficient increase in food production by regular means.

The United States Under-Secretary of Agriculture, Clarence McCormick, told the Council that his Government would continue to help in the fight to increase food supplies for humanity as a whole.

At its 16th session the Council elected two vice-chairmen, Ugo Papi of Italy and U Thet Su of Burma. The chairmen of its two main committees were Ambassador B. R. Sen of India and Perez Cisneros of Cuba.

The Council interrupted its discussion of world food and agriculture trends to consider an emergency food situation threatened in Yugoslavia. The chief of the FAO mission to Yugoslavia, Professor M. J. L. Dols of the Netherlands, reported widespread crop failures in that country as a result of drought, frost and hail. The report showed that Yugoslavia urgently required $65,000,000 worth of aid in food and seed before winter snow and ice made transport impossible. The Council unanimously instructed the Director-General of FAO to transmit a copy of its report to the Secretary-General of the United Nations and urged all member governments of FAO to consider immediately what assistance they could render to Yugoslavia and requested the Director-General to continue to extend, upon request of the Yugoslav Government, all appropriate assistance, technical or other, that lay within his authority and competence.

The Council concluded its debate on 'The State of Food and Agriculture,' noting that the critical shortage of rice in the Far East was the most important food problem facing the world at the present time and that a special meeting to consider ways and means of improving the situation would soon convene under FAO auspices.

Progress Report on Investment for Agricultural Development

It was reported to the Council that several countries had increased their facilities for agricultural credit and had eased loan conditions to farmers. FAO was assisting in this development by sponsoring seminars in agricultural credit and allied subjects in these areas to enable planners and administrators to make the best use of their capital resources.

The delegates discussed at great length the role of international financial arrangements in the field of agricultural investment. Particular attention was devoted to a proposal of the Economic and Social Council of the UN at its June session for a special fund to provide grants-in-aid to under-developed countries. This proposal is now under consideration by a UN committee of experts. The Council hoped that this committee would take advantage of FAO documentation on the subject and urged the Director-General to co-operate actively with the committee. The Council also drew the attention of governments to a report of the FAO Secretariat on the possibilities of short-term financing under the new policy adopted by the International Monetary Fund.

It was considered desirable to organise seminars and training centres on agricultural credit and related subjects in under-developed areas following the success of such undertakings in Latin America.

Pre-Conference Regional Meetings

The Council urged the participation of member governments at regional meetings to be held in South America, the Near East and the Far East during the summer of 1953, prior to the FAO conference in November. The aim of these meetings is to review national agricultural development programmes and to decide to what extent these plans can be instrumental in meeting the world's need for increased food production.

Progress of the Expanded Technical Assistance Programme

Deputy Director-General Sir Herbert Broadley reported that the expanded technical assistance programme had developed to the point where it was as large as and involved greater expenditure than the regular programme itself. The Council heartily approved the report and stressed several developments noted in it. Among these were: (1) Closer co-operation with all agencies involved in programmes of technical assistance. (2) Careful screening of requests for technical assistance and the general institution of a system of priorities in granting aid in view of the danger of requests exceeding available resources. (3) Maintenance of the principle of requiring governments requesting aid generally to contribute local operating costs of projects. All member governments joined in paying tribute to the achievements of the programme.

Pulp and paper supplies

FAO has developed a three-phase programme aimed at an increase in world pulp and paper production. Major attention has been devoted to the first phase, a survey of potentialities for expanding pulp and paper output. Twenty-five missions have been, or will shortly be, sent to member countries to appraise their potential pulp and paper capacity. Simultaneously, consultations are proceeding with the world's leading

pulp chemists and laboratories to determine the economic and technical feasibility of manufacturing newsprint and other papers from tropical woods, bagasse and other unconventional raw materials.

The Organisation's emphasis on the need to combine caution with boldness in developing new industries impressed the Council.

Agricultural migration

In the field of migration the Council believed that FAO could make an important contribution—within its resources and in association with interested governments—in three ways: (1) Selection and preparation of sites. (2) Establishment of suitable settlers. (3) Development of the settlements during the early years of their existence. FAO could only render such assistance in response to specific requests of member governments under the expanded technical assistance programme.

Commodity problems

The Council agreed with the report of FAO's Committee on Commodity Problems that rice continued to be the outstanding agricultural commodity problem in the world today. The Director-General's action in calling a special rice meeting in Bangkok on January 5 was approved. The Council noted the committee's conclusion that the heavy dependence on supplies from dollar sources was likely to continue.

Locust control

In the past year, reported FAO'S Locust Officer, only one area had suffered appreciable crop damage. Elsewhere control measures adopted by each country with the assistance of FAO and Point 4 equipment and personnel had been successful. FAO has recently released 100 hand dusting machines to the Yemen for use against the desert locust. FAO is participating in a meeting called by the Jordan Government to organise measures against swarms anticipated perhaps six months from now in that region. Co-ordination of locust control work is developing and the Council recommended that FAO establish and extend its co-operation with international committees in Central and South America.

Programme of work and budget for 1953

The Council took note of the report of its eight-member co-ordinating committee that the Organisation's budget—substantially the same as at the time of FAO's first conference in 1945—was not adequate to carry out the activities assigned to it by the conference. The Council said that the programme must be governed by present resources. Nevertheless, the Council was aware that expansion and development were inherent in the work of FAO and that it was desirable to have a budget consistent with its work load.

Emergency famine reserve

The Council agreed to form a body of seven experts on a study group to examine further details of the emergency food reserve plan. The following governments will be invited to select experts: Argentina, Australia, France, India, Netherlands, United Kingdom and United States. The experts will report before March 1953 to the Council. The Council also stressed the need for dealing with basic agricultural problems connected with emergency food shortages and famine.

Improvement of agricultural statistics

The Council approved the preparation of two manuals, one on the methods used for the collection of current agricultural statistics in different countries and another on the theory of sample surveys and its application to agriculture. The Director-General was invited to continue action on the organisation of sampling demonstration centres to investigate the place and possibilities of this method in improving existing systems of collecting statistics.

The Work of the Macaulay Institute for Soil Research

A MEETING of the Council of this Institute was held at Craigiebuckler on Friday, December 5, 1952, with Professor J. R. Matthews in the chair. The Convener of the Staff Committee, Dr. Murray Macgregor, in submitting the annual report, referred to the increasing interest taken in the work of the Institute and the large number of visitors from many countries welcomed during the year.

Post-graduate research workers from Australia, South Africa, New Zealand and Iceland were at present studying at the Institute and during the past year three students had graduated as Doctors of Philosophy in the University of Aberdeen, of which the Institute is a recognised centre for research.

The Deputy Director, Dr. A. B. Stewart, had recently returned from the United States, where he had been a guest speaker at a symposium on soil and fertilisers.

In a review of the work of the staff, Dr. Macgregor referred to the co-operation between the Institute and the Scottish Colleges of Agriculture, whereby the result of fundamental research was made available to the farming community.

Over 8,500 samples of soil had been tested by the Institute from the North of Scotland College area and advisory work on forest nursery problems had increased. Reports on soil and produce from areas presenting either crop growth or animal health problems have been sent to sister research institutes and several surveys have been made in connection with sheep pining, heather management and forest problems.

Professor Phemister, in submitting his report on site and buildings, referred to the demands upon the laboratory accommodation.

A brief summary of departmental work includes the following activities:

X-ray investigations — The study of the mineralogy of Scottish soil clays was continued. Clay fractions from Norwegian and Turkish soils were also examined. Investigations into the weathering of granite were continued. Samples of montronite from different localities were compared.

Physico - chemical investigations — Differential thermal analysis studies on Scottish soil clays have continued and the results have been compared with X-ray data.

The distribution of clay minerals and the trends down the profiles have been examined for various soil types. In addition to soil clays, montronites, dolomites and sulphides from various localities have been examined.

On the chemical side the investigation on methods for removal of free iron oxides from clays is practically complete. These have been extended to include the products of grinding muscovite.

Promising results have been obtained from the electrophoretic method of separating clay minerals.

International co-operation in correlation of thermal analysis results has continued and considerable advances have been made. This subject was one discussed at the XIX Session of the International Geological Congress in Algiers, attendance at which was possible through facilities granted by the Agricultural Research Council. A set of three lectures on clay mineralogy and soil science was delivered in Spain on the invitation of the *Consejo Superior de Investigaciones Cientificas*.

Spectrochemistry—The determination of alkali and alkaline earth metals by

flame photometry (11,000 samples) and flame emission spectrographic methods (2,000 samples) has been continued. These analyses were carried out on behalf of the Departments of Soil Fertility, Plant Physiology and Pedology.

Trace elements in soils, plants and biological materials have been determined by the cathode layer arc technique; some 1,800 samples have been examined for up to 16 constituents.

In addition to soil and plant samples from Institute sources, samples have been analysed in collaboration with the Animal Diseases Research Association, the Rowett Research Institute, the Hannah Dairy Research Institute, the National Agricultural Advisory Service of England and Wales and various Commonwealth sources.

Pedological and geochemical investigations of the occurrence of trace elements in soil profiles and soil parent materials, such as rocks and minerals, have been continued.

Work on the improvement of spectrochemical methods has included an intensive study of the possibilities of the porous cup solution spark technique. Electronic equipment, including a flame photometer and a display microphotometer, is in course of development.

Absorption spectrophotometry of organic constituents has included the continuance of the study of the lignin of sphagnum.

Soil organic matter—*Biochemistry*. In the chemical study of soil organic matter the presence of rhamnose soil has been fully established, the technique for quantitative determinations of amino - acids improved and the study of humus directed towards new lines.

Microbiology. In the Microbiological Section bacteriological work has also continued on the lines indicated in last year's report, while mycological studies have opened up a new field of study of humus formation and produced several interesting lines for further study.

Radioactive studies.—The work of the Radioactive Section has been along three main lines. In the study of the phosphate relationships of soils the use of P as a tracer has been continued. The autoradiograph technique has been used to determine the distribution of mineral nutrients in the plant. A new application of radioactive material, other than as a tracer, has been made in an investigation of a method of determining soil moisture.

Soil fertility—*Chemistry and field experimentation*. The improvement of soil fertility in the broad sense of improving both the yield and the feeding quality of crops continues to be the ultimate aim of the three main types of investigations in progress, *viz.* field experiments, pot experiments and laboratory studies. Field experiments under varying conditions are indispensable to the characterisation of the factors determining soil fertility and to the assessment of the results of pot experiments and laboratory studies. Accounts of results to date have been given in various publications and in contributions to (1) a symposium on soil and fertiliser phosphorus in crop production held in the United States, (2) the Sixth International Grassland Congress held in the United States and (3) the meeting of the International Society of Soil Science held in Dublin.

Field experiments. One of the main aims of these is the characterisation of the yielding capacity and nutrient status of contrasting soil types. To this end experiments conforming in design to modern statistical requirements are in progress on such subjects as the responses of individual soils to various manurial and liming treatments, the phosphate relationships of soils and methods of fertiliser application.

Pot experiments. To supplement the basic data obtained in the field pot experiments have been undertaken with reference to the study of (*a*) the availability of superphosphate after varying periods of contact with different types of moist soil, (*b*) the use of radioactive phosphorus to estimate the availability of phosphate residues in samples from field plots and (*c*) the possible effects of Krilium soil conditioner on the availability of native and applied phosphate.

Laboratory work. Intensive analytical work has been undertaken on soil and produce samples from the field and pot experiments and special attention given to (1) the characterisation of soils, (2) the effects of different treatments on the mineral composition of crops and (3) the study of soil phosphate problems, especially that of evaluating the phosphorus status of soils by laboratory methods. Papers describing results obtained in the study of manganese problems and in physico-chemical studies have been published.

FAO Forestry Mission for Chile

Perhaps the most important achievement of the FAO Forestry Mission to Chile in the first year of its assignment has been its contribution to revisions in forestry legislation. The Mission advised a committee set up by the Ministry of Lands and Colonisation which has drafted a bill representing a real advance over existing legislation along the following lines: Provisions for safeguarding remaining national forest areas from destruction or unwise disposal; regulations for the protection and rational management of forest lands, including those privately owned where the national interest so requires, as in water-shed areas; creation of a more adequate forest service; provision for forestry education and research.

The main forest problems of Chile, as determined by the Mission, are protection of natural forests, protection of the soil against erosion, need for management of forests for sustained yield and necessity for the better organisation of timber production. The Mission is undertaking detailed studies and proposals for action on the above problems in limited areas. These will serve to demonstrate the utility of corrective or remedial measures.

An important result of the Mission's activities has been the decision of the Government of Chile to establish a Forestry Faculty in the University of Chile. FAO has agreed to furnish three instructors for the initial period of this school.

A demonstration forest, for research and training, is also to be established, which will be a summer teaching area for the forestry students. It will also serve as a demonstration area for industrial operators interested in more modern methods. Modern methods of mechanical extraction and an up-to-date sawmill for the processing of the timber derived from the area under a sustained-yield working plan, will be included. FAO is providing equipment not readily procurable in the country, and Chilean authorities are providing the necessary buildings and operating staff and assuming full maintenance responsibility.

Soil conservation, particularly in the northern arid region and in coastal areas affected by shifting sand dunes, presents a very important problem in Chile. FAO's Forestry and Agricultural Missions are working together to determine the extent of the erosion problem. A plan for control in an important sand dune area has already been presented.

As regards the organisation of timber production, there already exists a definite pattern of forest economy in Chile. The Mission is not attempting to alter radically the structure of this economy but to introduce such improvements as are possible in existing methods of felling, logging and conversion. A general study is being made of present methods of exploitation and of existing forest industries in Valvidia province, in cooperation with the Corporación de Fomento, with a view to developing an integrated forest industry in the province.

(From *Unasylva*.)

CORRESPONDENCE

The Lelydorp Plan

TO THE EDITOR

Sir,

It was with great interest that I read Mr. Grist's article on ' Agricultural Development in Surinam ' in the October 1952 issue of WORLD CROPS.

We appreciate greatly that the work we are trying to do here in this part of the world was given so much attention in a journal of international standing as WORLD CROPS.

I am now four months here as the leader of the Lelydorp Plan, carrying on the work my predecessors have done during the last two years. Until now about 300 hectares of swamps forest have been cleared, drained and cultivated; the land is divided in farm plots, roads are built, and as a start ten houses and stables are set up.

Next year about 100 hectares more will be reclaimed and at the end of 1955, when about 45 farms will be occupied, we will have finished this pilot scheme.

One by one the farmers are coming in after careful selection; they will be kept under continuous control and guidance during the first three years. This is necessary because our farms are of a considerably higher standard than the farm types usually found in this country.

Our approach is not the extension service method for development of new techniques of land utilisation by the modification of the existing traditions and farm practices within the community or the village. However essential the extension way of land development may be, the Lelydorp Plan is a complement which tries out the reverse, *i.e.* the more direct approach of raising the farm management to a high technical and economic level and bringing in individual farmers expected to be capable of running a far more complicated system than they have been used to.

As a consequence the farms of our Plan are not occupied by representatives of a single group, but by individuals of different groups and even races. We expect that the many common interests of the farmers will make possible sound co-operation between the members of this new group in the future.

From this point of view our object is rather ambitious, but if we wish to raise the standard of living of this country we have to strive after a high production per farmer, because Surinam is under-populated and the costs of reclamation and the capital investments are rather high.

The farms we are planning are mixed farms of three sizes, *i.e.* 5, 8 and 11 hectares. The economic backbone is commercial crops, cacao, oil palm, citrus; in addition to this, food crops for the farmer's family and fodder grasses for five to eight cows. The introduction of cattle is in the first place intended to supply the organic manure necessary for the poor sandy soils; in the second place milk cows are an important asset for the financial proceeds of the farm. The planning of different crops makes the farm management as a whole less risky and will lead to a more even distribution of labour over the year.

The whole project is paid for out of a Welfare Fund of the Netherlands, but it will be taken over by the ' National Ten-Year Plan ' which will soon be established.

The capital investment of the 11-hectare, 8-hectare and 5-hectare farms will be respectively 18,000, 14,000 and 10,000 Surinam guilders. This investment has to be paid back by the farmers in about 15 years, dependent on the returns of the farm.

Yours faithfully,

J. H. DE HAAN.

Paramaribo, Surinam.
November 13, 1952.

Jute Prices

TO THE EDITOR

Sir,

The opening statement in the review of the book *Jute Substitute Fibres* (see your December issue) that ' the enormous rise in price of jute which has taken place of late years has directed attention to the possibility of using other fibres to replace it ' must create a wrong impression in the minds of your readers about present-day jute prices. It is true that in the spring of 1951 the price of raw jute reached a record high peak of £240 per ton, but in the next 18 months it dropped steadily till it reached £80 per ton in July of this year. It was recently increased to £85 per ton and in comparison with other commodities is considered to be at least at a reasonable level.

Yours faithfully,

STANLEY SMITH.

The British Jute Trade Federal Council,
64 Barrack Street,
Dundee
December 17, 1952.

Rice Production in Indonesia

It has recently been announced in Medan by Gunung Iskandar, Secretary-General of the Indonesian Ministry of Agriculture, that details are now complete for schemes which will enable Indonesian rice production to meet all local requirements within the next five years.

The putting into effect of these schemes will involve the reclamation and opening up of new land and the construction of dams and irrigation schemes which will help to make fertile what is at present waste land. This reclamation work is to be undertaken by the State Agricultural Organisation which will launch the several rice cultivation projects, each extending over several thousand hectares.

A start has been made, in North Sumatra, on the building of new roads. From this area alone an additional 30,000 tons of rice is hoped to be produced.

In East Sumatra the tractors to be used in the opening up of 2,000 hectares in Aek Natas and Gunting Saga have arrived. Agricultural experts from the United States and France are to leave Jakarta to work on this project, which is, as yet, on an experimental basis. The success of this experiment would be the sign for going ahead with plans for increasing rice production in Sumatra and Borneo, where large-scale reclamation work is being carried out. On the Borneo reclamation project the Indonesian Government is spending Rp. 600 million.

The first of the new dams to be started is at South Tegal, where the foundation stone was laid at the Tjatjaban Dam on September 16 last. Water from this dam is to irrigate over 40,000 hectares of rice land and is also to make possible the establishment of new industries. Six new dams are also to be constructed in Solo for the irrigation of 17,000 hectares of rice land.

Also, under the schemes, further assistance will be extended to farmers by making available tractors and other mechanical equipment. Assistance will also be provided for the establishment of cooperatives and credit societies.

The target represented by all the schemes is an increase in Indonesian rice production by half a million tons annually. The irrigation works constructed in Java before the war under Dutch guidance never fail to impress all who have seen them.

If the new schemes to be undertaken are characterised by the same technical excellence of their predecessors, there seems to be no obvious reason why this ambitious target should not be attained.

FARM MACHINERY

The new B-3-R bale loader with right-hand connections—being produced by the International Harvester Co. of Great Britain Ltd. for the coming hay season

Right-Hand Bale Loader

International Harvester Co. of Great Britain, Ltd., announce that this year they will be in production of a right-hand version of the B-3 Bale Loader. The machine previously manufactured was attachable to the left-hand side of the tractor, vehicle or trailer. The modification in design has been brought about to meet the demand from home and certain overseas markets for equipment to work with right-hand drive motor trucks, and now the whole operation can be carried out in direct view of the driver of such a vehicle.

An additional convenience which also applies to those operating with tractor/trailer combinations is that the outfit may now work round the field in the same direction as a pickup baler and follow closely behind if necessary.

The new machine will be known as the McCormick International B-3-R Bale Loader and will be available in good time for the hay harvest.

Two recent additions to the range of implements available for the Ferguson tractor, which were exhibited at the recent Smithfield Show. (*Top*) **mounted tandem disc harrow with automatic working depth control.** (*Bottom*) **buckrake with hydraulic control of tine pressures over ground contours**

Orchard Fruit Sprayer Demonstration

A range of fruit tree sprayers, together with a new ground crop machine, was recently demonstrated in Essex by Messrs. Ernest Doe and Sons Ltd. Here growers were able to see the new range of machines for the 1953 season made by Messrs. Kent Engineering and Foundry Ltd.

Autoblast conversion

The most interesting feature of this demonstration was a new method of converting an ordinary high pressure trailer sprayer into the autoblast system of working—known as the Autoblast 5. This unit is powered by a 10 h.p. Ford commercial engine which is coupled by a KEF gearbox to the fan, while the spray pump is driven from the tractor power-take-off. Another feature is that cooling is effected by utilising surplus air from the bottom of the fan. Interchangeable discs enable outputs of 50 to 400 gal. per acre to be obtained; radius of effective spraying is about 30 ft. The machine, which costs £325, enables the grower who has a high pressure trailer sprayer to convert to the autoblast system so that his machine can spray to both sides on standard fruit, etc., and give a good cover either at high, medium or low volume.

The Autoblast 3, a 250-gal. machine, with fan and pump driven by a Ford V8 engine, was also shown. This is a completely self-contained unit and can be hauled by any medium-sized tractor without difficulty. Price of this machine is £1,140 10s. 0d.

A 200-gal. capacity sprayer, which is reported to be having considerable success on East African coffee plantations is the Autoblast 4, also designed to work behind the average tractor. It has no engine of its own, the pump and fan being driven by the tractor power-take-off shaft. A new machine, this costs £475.

Spraycrop 25

The KEF Spraycrop 25 was first shown at the recent Smithfield Show. This, the makers claim, can be used on all ground crops at high, low or medium volume. Powered by a 5 h.p. engine it is fitted with a 200-gal. tank and 25 ft. boom, adjustable in height from 18 in. to 50 in. from the ground. Lift pendants can be fitted to the boom and the track is adjustable from 3 ft. 6 in. to 5 ft. 6 in. The price is £295 10s. 0d. Overall dimensions are, length 8 ft., width over folded boom 7 ft. 6 in., height to top of tank 4 ft. and weight unloaded 10 cwt. The machine is adaptable to any tractor, the drawbar being hinged and adjustable.

Italian crawler

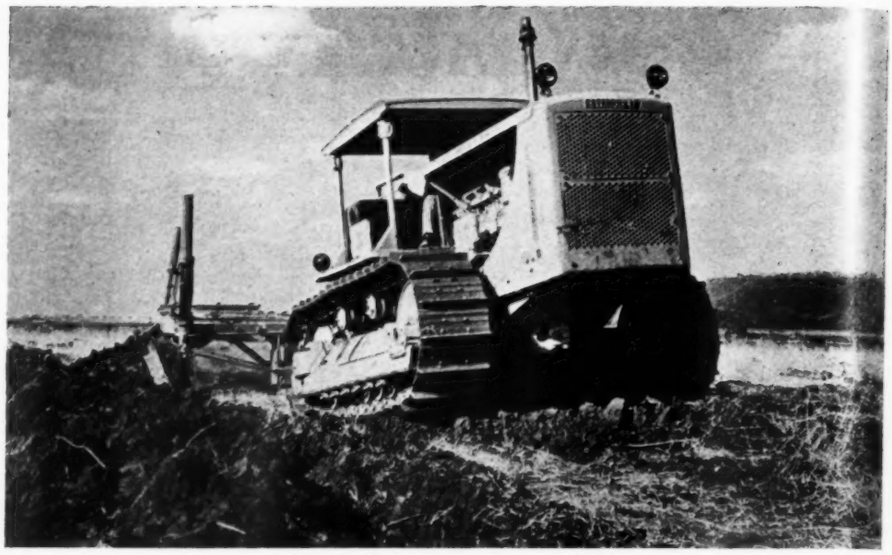
Also on view at the demonstration was the Fiat 35 crawler tractor, the Turin-manufactured tractor which is now available in the U.K. It has a drawbar pull of 7,700 lb. and 12¼ tracks giving ground pressure of 5.25 lb. per sq. in. Powered by a four-cylinder diesel engine it has six forward and two reverse gears and a 24-volt electric starter. The price is £1,895.

DDT Factory for Delhi

The proposed DDT factory in Delhi is expected to go into production ten months earlier than the scheduled date, it was stated in New Delhi on November 13.

The United Nations International Children's Emergency Fund along with the WHO (World Health Organisation), co-operating with the Government of India in setting up the factory, has, it is learnt, decided to divert to India the plant which was originally to go to Ceylon. The despatch of this plant is said to be almost ready and it is expected to arrive in January or February next. The plant, which has a capacity to produce 700 tons of DDT annually, will go into production in the third quarter of 1953, instead of the scheduled date of June 1954.

The cost of the plant is borne by UNICEF, while the WHO will provide highly skilled technical personnel for the erection of the factory and its initial operation. They will also train Indian technicians.

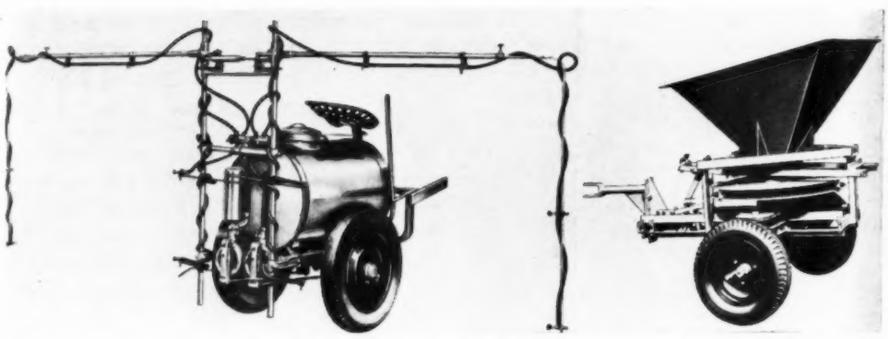


Caterpillar diesel D3 of India's Central Tractor Organisation pulling a disc plough in previously cleared jungle near Bhopal

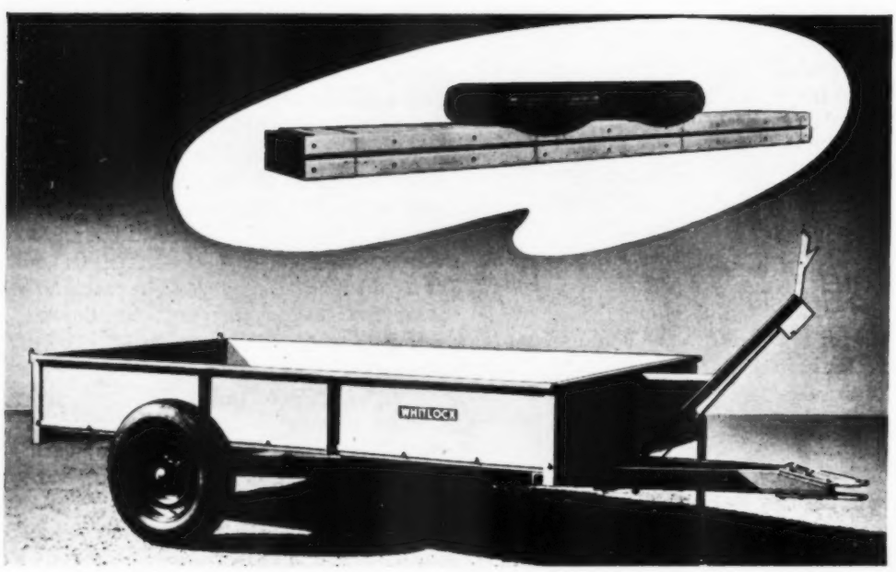
Massey-Harris Change

Mr. James S. Duncan, chairman of the board of directors, Massey-Harris Ltd., Manchester, regrets that Mr. G. H. Thomas has signified his intention to retire from his position as managing director of the Company.

Mr. Lionel Harper has been appointed managing director, replacing Mr. Thomas. Mr. Harper has been a member of the Massey-Harris organisation for 25 years, 16 of which have been spent in the British business.



Two machines seen at the recent Smithfield Show. (*Left*) **The 'Renovex' spraying machine, fitted with rubber diaphragm pumps driven by cams on the axle, made by Cooper, Pegler & Co. Ltd.** (*Right*) **The new Webb 'Quicspread' distributor which, working on the spinner plate principal, spreads to a width of 20 ft. when travelling at 3-4 m.p.h.**



An example of Whitlock's new 'Hardiway' form of all-steel trailer construction, the inset shows the same trailer packed for export. Made by Whitlock Bros. Ltd.

Microsol Demonstration

A demonstration of the Microsol aerosol generating machine (see WORLD CROPS, 4, 11, p. 347) was recently given to the British Food Manufacturing Industries' Research Association at Holborn Hall in London. The demonstration was attended by a large number of members of the food trade who were able to form some idea of the potentialities of this type of machine for treating stored foodstuffs against pest infestation.

The model demonstrated was the '202,' an indoor machine having a container of ½ gal. capacity and powered by electricity.

Tractor Exports to Denmark

An order just received for £100,000 worth of tractors for Denmark brings the total value of 1952 exports to that country by David Brown Tractors Ltd., of Meltham, Yorkshire, to half-a-million pounds.

IH Acquisition

International Harvester Company has acquired the stock of The Frank G. Hough Co. of Libertyville, Illinois, manufacturers of earthmoving, excavating and material-handling equipment.

A recent announcement stated that from November 1 the Hough Company became a wholly-owned subsidiary of International Harvester.

Many of the Hough products have been marketed by International industrial power distributors for many years in the United States and overseas distribution has been handled by the International Harvester Export Company.

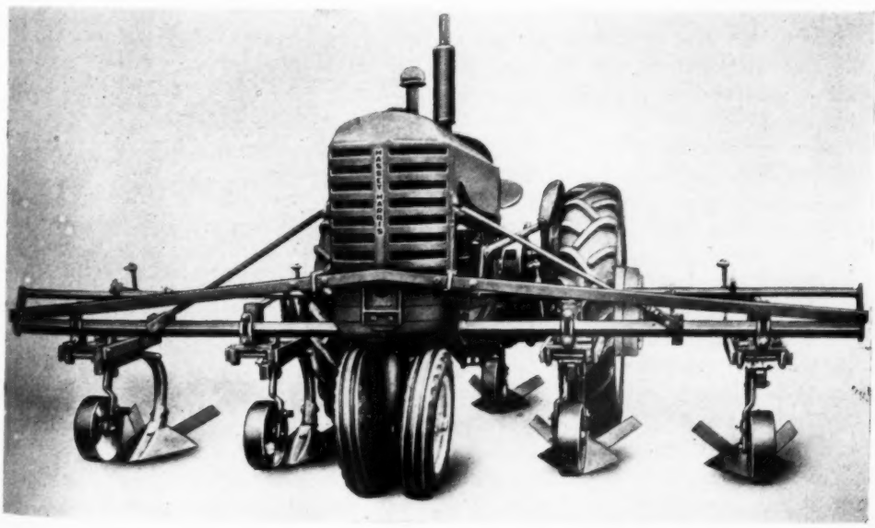
Christmas Acknowledgments

We have received, during Christmas, cards and calendars from the following : Allman Overseas, Caterpillar Tractors, Clean Crops, Dolphin (Genoa), Norris Evans, Dr. C. de Fellner, Harry Ferguson, Fuerst Bros., R. W. Gunson, Hercules Powder Co., Hunting Aerosurveys, I.C.I. (Central Agricultural Control), International Harvester Co., Massey-Harris, May and Baker Ltd., Murphy Chemical Co., National Institute of Agricultural Engineering, Pest Control, Plant Protection, Rotary Hoes, Shell Petroleum, Sorexa, Universal Crop Protection, Watkins Seeds (New Zealand).

We acknowledge these with many thanks and at the same time take the opportunity of wishing all our readers a happy and prosperous 1953.

David Brown Trackmaster hauling a two-furrow deep digger plough up a 40-ft. slope in the Te Peka (Ontario) district of New Zealand, during reclamation of scrub-infested slopes on a 943-acre farm

Mr. Lionel Harper, recently appointed Managing Director of Massey-Harris Ltd. (see opposite page)



A bedder-cultivator, made by Massey-Harris Ltd., used for inter-row cultivation, eliminating weeds and maintaining the beds. Ground tools available include bedding sweeps, wide cultivating attachments, chisel teeth for breaking hard-pan and pulling discs for cultivation of crops planted on the flat

The New Year Honours

In the British New Year Honours List appear the names of the following for services connected with agriculture, to whom WORLD CROPS tenders its respectful felicitations:—

KNIGHT BACHELOR

Eric Crawford Tansley, C.M.G., Managing Director of West African Produce Marketing Companies.

C.H.

F. Grant, Under-Secretary, Ministry of Agriculture.

K.B.E.

Sir Patrick Ramsay Laird, Secretary, Department of Agriculture for Scotland.

Colin Archibald Sinclair, a prominent grazier and pastoralist. For public services in Australia.

C.M.G.

E. R. Greene, lately Director of Coffee Division, Ministry of Food.

C.B.E.

D. Christy, Provincial Land Commissioner, Ministry of Agriculture.

G. R. Davies, Chairman, Radnorshire Agricultural Executive Committee.

G. B. Fielding, Director, Cotton Spinners' and Manufacturers' Association.

H. R. Humphries, Director, Animal Feeding Stuffs Division, Ministry of Food.

D. N. McArthur, Director, Macaulay Institute for Soil Research, Aberdeen.

J. Macdonald, Director of Research and Education, Forestry Commission.

G. S. Peren, Principal of the Massey Agricultural College, New Zealand. For service to agriculture.

Technical News

In the current (February) issue of *Manufacturing Chemist* there is included an article entitled ' New Agricultural Fungicides,' by H. Martin.

The current issue of *Food Manufacture* is a special packaging number and features a description of exhibits at the Packaging Exhibition; also a review, ' Progress in the Packaging Industry During 1952,' by J. H. Buck.

Chemical and Process Engineering includes an article by J. P. Duffy, ' Rates of Drying in Tray and Rotary Dryers.' In *Petroleum* is included an article on ' The Oilfields of Borneo.'

Muck Shifter and Public Works Digest includes two articles: ' Foundation Problems and Their Solution,' by Rolt Hammond, A.C.G.I., A.M.I.C.E., and ' The Case for the Severn Barrage,' by Noel D. Green. In *Fibres (Natural and Synthetic)* there is an article entitled ' Improved Process for Stripping Coloured Wool Waste,' by A. J. Hall, B.Sc., F.R.I.C., F.C.I.

NEW BOOKS

Magnesium Ein Pflanzennahrstoff

Magnesium as a Nutrient. Pp. 216, illustrated. Deutscher Innen- und Aussenhandel Bergbau, 1952.

This book, issued by the Mining Section of the official East German Trading Organisation, is the first of a series of publications dealing with plant nutrients. It is a collection of essays on the part played by magnesium in safeguarding crops. The editors do not claim comprehensiveness nor indeed do they claim to have produced anything but a random collection of important contributions on the subject.

In their introduction they stress that the recognition of magnesium as an important contribution to soil fertility is comparatively recent. Moreover, the problem has only arisen since potash salts with low potassium contents have been superseded by those with high contents practically free from magnesium. There is now a danger of magnesium deficiency in the soil, which is all the more serious as crops take a considerable quantity of magnesium out of the soil, and soil exhaustion in some areas has, it is claimed, reached a stage when magnesium must be regarded as the fifth, in rank, of the vital nutrients, being preceded only by nitrogen, phosphoric acid, potash and calcium.

The individual contributions to the book include two from Professor A. Jacob, Ph.D., on fertilising problems, three from Professor K. Schreiber on the influence of magnesium on crops, while Professor A. Arland, Ph.D., comments on the latest trends in soil research. Further, more specialised contributions come from other German agricultural scientists on the part played by magnesium in modern cultivation.

A valuable feature of the book is the bibliography appended to each article, although it is mostly confined to German sources.

Colonial Territories

An Economic Survey of the Colonial Territories, 1951-52. Vol. VII: The Products of the Colonial Territories. Pp. 250. H.M.S.O., London, 1952. £2 2s.

It is now over 20 years ago since the first edition of the Economic Survey of the Colonial Empire was published by the Stationery Office. It was prepared by the Economic Department of the Colonial Office, of which the Assistant Secretary in charge at that time was Mr. (later Sir Gerard) Clauson. From its first appearance the work became recognised as an authoritative and almost monumental source of information about production and economic matters in the Colonial Dependencies. It was, in fact, familiarly and affectionately known among the more junior ranks of the Colonial Office civil servants as ' Clauson's Bible.'

The book was revised and republished yearly until the 1937 edition which appeared in 1940, whereafter the strains and preoccupations of war prevented the not inconsiderable labour of compilation being continued.

Now we are glad to see that the publication of this invaluable compendium has after an interval of 16 years been resumed. In the interval much has happened; the stress of war has effected great alterations in the number and status of the ' colonies.' Some, like Ceylon, have attained ' Dominion ' status, others like Israel have assumed the position of independent sovereign states; in many there have been considerable alterations in the character of their trade and the manner in which it is conducted, the establishment of the West African Marketing Boards being an example of the latter.

In the present edition the information formerly compressed into one thick foolscap volume has been expanded until it fills seven volumes of the same size and from being a book the survey thus becomes a library. The first six volumes deal sectionally with the economic features of the Colonial territories by geographical regions, while the seventh deals in detail with the commodities produced in the Colonial territories as a whole. Like its predecessor the work constitutes a unique and, to the seeker after information, invaluable assembly of information.

At the same time one trusts that it will not savour of *lese majeste* to express some regret that it was no longer possible to compress all this into one volume, while it also seems a pity that the Stationery Office should have once more demonstrated their affection for flimsy paper covers and a general format which must inevitably fall to pieces with constant handling.

The earlier editions of the Survey were accorded a more robust format. One can well appreciate that if it is intended to make the publication of new editions an annual event, an inexpensive format may be desirable in the interest of economy, but it seems permissible to doubt whether an annual republication is a practicable proposition. In any event one would imagine that the private purchaser of an example of this invaluable encyclopaedia of information would prefer to have it in a binding pleasing to the eye which will ornament the library shelf and be calculated to withstand the frequent handling to which it will be subjected, even although this may bring in its train some augmentation of its published price.

Agricultural Legislation

Annuaire Internationale de Legislation Agricole, XXXIIIme-XXXVme Annee, 1943-45. Pp. 974. FAO Rome, 1952. $5.00 or 25s.

This is the continuation of the Annual Review of Agricultural Legislation throughout the world, which was formerly published by the now defunct International Institute of Agriculture—replaced by FAO. This series was continued yearly till 1942 and was then stopped by the war. The present volume summarises the main legislation passed from 1943 until 1945. It is not the present intention to publish the documentation available for the subsequent years, and this series ends therefore with 1946. Starting from 1952, it is intended to publish a review of agricultural legislation every three months.

E.N.I.T.

E.N.I.T. Diary gives in monochrome and colour an idea of Italy through the work of its living artists. All the reproductions interpret some particular locality, but the pictures show life and still life and abstracts. This is indeed the desk diary jocund and de luxe. We are indebted to Dr. Borri of the office Turismo of Parma for the gift.

To Authors and Readers

The Editor and Publishers of WORLD CROPS will be glad to consider manuscripts of books submitted for publication. We already publish a number of books on technical subjects, all of which find a world sale and most call for regular reprints and new editions.

Books of a non-fictional type in any language by any publisher can be supplied by the Book Department of WORLD CROPS.

WORLD CROP REPORTS

EUROPE

Record 1952 rice crop. European countries last year again harvested record rice crops. Further substantial expansion of rice acreage took place during the 1952 planting season, continuing the upward trend of the post-war years.

Italy's new record rice acreage increased from the high level of 1951, and excellent weather has resulted in prospects for a crop considerably larger than the good harvest of a year earlier. In **Spain**, larger rice acreages were planted again and despite some losses due to worms and to flood water in limited areas, a record harvest was expected.

The acreage in **Greece** was increased in 1952, and weather conditions were more favourable for production than in 1951, when relatively low yields per acre were harvested. Greece may be self-sufficient this year in rice for the first time on record. Similarly, in **Portugal** and **France**, larger areas were planted in rice than in 1951, and the crops were 9% and 13%, respectively, larger than the previous record production of a year earlier.

GREECE

Tobacco acreage reduction. Greece's 1952 tobacco acreage is estimated at 20% below 1951, while production is reportedly down 32%, according to the American Embassy, Athens. Exports of unmanufactured tobacco during January-August 1952 were 33% above the exports during the corresponding 1951 period. It is reported that Greece and the Soviet Union have a barter deal arrangement which involves about 9 million lb. of tobacco.

The country's 1952 tobacco production is preliminarily estimated at 93.2 million lb. as compared with 137.1 million lb. in 1951. This season's decrease is attributed primarily to a combination of a decrease in acreage planted to tobacco and unfavourable growing conditions in some producing areas. However, the quality of the leaf is reported as above average. The acreage decrease was due largely to the following factors: low prices received for the 1951 crop; delay in liquidating the 1951 crop; exceptionally large stocks on hand; adverse weather conditions at planting time; and the delay in receiving so-called cultivation loans. These conditions caused many growers not to plant in 1952, thus reducing the number of tobacco growers to 115,897, compared with 141,927 in 1951 and 141,000 in 1950.

ARGENTINA

Grain prospects. Reports from all parts indicate an excellent wheat harvest with yields in Eva Peron Province above normal while Santa Fe is averaging 18 quintals per hectare. Linseed in the same province is also good.

Wheat harvesting has started in southern Buenos Aires and will be general by mid-January.

EAST CHINA

1952 harvest reports. The 1952 harvest in East China was the best since the war, says the New China News Agency, quoting a report issued by the East China Administrative Committee.

The Committee announce that the crops which topped pre-war figures are: grain by 16%, cotton by 79%, tobacco by 100%, tea by 11% and marine products by 12%.

The Laiwu State Farm created a new yield record for wheat with 5,800 kg. per hectare (approx. 5,300 lb. per acre). Whilst the target for rice of 7,500 kg. per hectare was surpassed, according to the Committee's statement, by the majority of growers.

During the year 470,000 wells were sunk and a feeder canal built in the area, whilst irrigation ditches were repaired in more than one million places. About three million acres of land were affected by this repair and irrigation scheme.

BRITISH WEST INDIES

Sugar statistics. The following interesting forecasts of production during 1953, with comparable figures for 1950 to 1952, together with estimated local consumption during 1953 are published by the British West Indian Sugar Association :—

Long tons Raw Sugar Value	1953 *Estimate*	*Production* 1952	1951	1950	*Consumption* 1953
Antigua	25,650	34,254	18,821	31,121	3,150
Barbados(*a*)	147,000	167,875	187,665	158,182	10,000
British Guiana	245,000	225,567(*b*)	217,306	195,651	16,600
Jamaica	295,050	265,871	267,928	271,582	70,000
St. Kitts	51,000	50,613	44,272	41,204	3,000
St. Lucia	10,800	9,203	9,825	10,441	1,700
Trinidad	134,500	137,358	140,632	146,508	23,000
Total B.W.I.S.A. Territories	899,000	890,741	886,449	854,689	127,450
British Honduras		2,131	1,800	1,461	
Grenada		1,905	2,758	1,669	
St. Vincent		3,365	2,791	2,750	
		898,142	893,798	860,569	

(*a*) Including fancy molasses. (*b*) Latest estimate.
(From Czarnikow's *Sugar*.)

WORLD

The world rice crop in 1952 - 53 (August-July) is expected to be the largest record, and considerably above that of the preceding two seasons, according to the first estimate of the U.S. Office of Foreign Agricultural Relations.

The 1952-53 world harvest of rough rice is forecast at 176 million short tons, an increase of 8 millions tons compared with last year's production of 168 million tons. The previous post-war record was 171 million tons harvested in 1948-49. This season's harvest is 5% larger than the 1951-52 crop, 5% above the pre-war average (1935-36/39-40), and 8% larger than the post-war average (1945-46/49-50) production.

The harvests in progress in the Northern Hemisphere generally are yielding larger crops. China, Japan, and Korea have increases in output, and expanded production is being harvested in the northern countries where new areas have been planted in rice. The increase in general is estimated at 12% in European areas of production and 8% in North America.

Increased production was also anticipated for most of the countries where the crop was harvested mainly in December. These include India, Pakistan, Indo-China, Burma, the Philippine Republic, and Ceylon. The rice crop of India, the largest producer next to China, is reported very good. The 1952 rice crop of Thailand is reported as only fair.

Rice acreage is being increased in South America, where the crop will be harvested from March to May 1953. Should weather be normal, the rice production there will exceed that of the preceding year. In Africa, although the harvest of Egypt declined again in 1952, the Continent's total production will show a gain from that of a year earlier.

With the exception of Egypt and possibly Thailand, and Mexico, rice production in the countries usually having a surplus for

export is larger than a year earlier. The total increase in the surplus countries is estimated at more than 1 million short tons of rough rice. The largest increases in the exporting countries are in Burma, the United States, and possibly Brazil.

INDIA

Coffee prices and prospects. Mr. Ivor Bull, Chairman, Indian Coffee Board, addressing the meeting of the Board in Bangalore, described the increase in coffee prices as ' painful to the consumer and both dangerous and undesirable for the producer,' and said that with the new season's crop estimated at 21,000 tons, the Board would hold adequate stocks to enable them to control the market at still lower levels.

Much of the shortage of coffee in the market, he said, appeared to be the result of manipulation rather than real. The decision of the Government to cancel the proposed reservation of 2,000 tons of export coffee for 1952-53 had played a major part in reducing internal prices from the excessive levels of September. He estimated coffee consumption at about 18,000 tons a year.

The coffee crop for 1952-53, Mr. Ivor Bull said, though higher than the six-year average, was nevertheless disappointing. ' Blossom showers were early, and in many districts were too early for arabica. Yet they seem to have suited robusta, and a very heavy crop of this type of coffee is expected. There is little we can do about failures of the monsoon, but when the weather returns to normal we must expect to harvest a substantially larger crop than we are picking today, for the area under coffee shows a steady extension and yields from the old coffee are rising in many districts.'

(From *Indian Trade and Industry*.)

ZANZIBAR

Poor rice crop. The 1952 rice crop was a very poor one due to the unfavourable weather throughout the season, reports the Protectorate's Department of Agriculture.

At the end of 1951, the longest and heaviest *vuli* rains for many years were experienced and it was impossible to get on to most of the rice land until well into the new year. Many valleys remained flooded for even longer. As a result, rice cultivators could not prepare their land until it was much too late and only about a quarter of the usual acreage was planted in Zanzibar island.

In Pemba somewhat better conditions prevailed and, since the practice there is to plant rice at the commencement of the main rains in March, rice cultivators had more time to prepare their land and the usual acreage was planted.

But troubles did not end there. In both islands the *masika* rains stopped very early and were probably the worst for half a century. The rice in Pemba, later planted than Zanzibar, suffered very badly and the average yield per acre was less than half normal. In Zanzibar the reduced acreage, planted in January, was able to make better use of the limited rains and better yields were recorded. These were about 20% less than the previous year.

The final result was a rice crop of about a third of the average for the Protectorate. This has caused hardship amongst rice growers and was expected to be the cause of seed shortage when planting the 1953 crop.

Altogether 12,353 acres were planted in Pemba Island yielding 3,541.4 tons paddy, or an average of 626 lb. per acre. In Zanzibar 3,323 acres were planted yielding 1,779.9 tons paddy, or an average of 1,200 lb. per acre.

A load of cocoa pods being unloaded at Kokopo, New Guinea. Production of this crop is still very much in the development stages

CANADA

Tobacco production. Despite the sharp reduction in the area under tobacco in Canada from 119,000 acres in 1951 to 91,500 acres in 1952, production over the same period has shown only a moderate decline from 154 million to 135 million lb.; the average yield of 1,476 lb. per acre in 1951 was nearly 200 lb. more than in the previous year and well above the previous record yield of 1,335 lb. per acre in 1941. Ontario's flue-cured crop alone is estimated at 124 million lb. with an average yield of 1,523 lb. per acre, being therefore only 12% lighter than that of 1951 as against a reduction in acreage of 23.5%.

(*Commonwealth Economic Committee*.)

SWEDEN

Smaller oilseed harvest. Sweden's 1952 oilseed production has been estimated at a total of 217,000 short tons from 365,000 acres, according to the American Embassy, Stockholm.

Statistics for the various oilseed crops are shown in the table below:—

Crop	*Area*		*Yield per Acre*		*Production*	
	1951	1952	1951	1952*	1951	1952*
	1,000 *Acres*	1,000 *Acres*	*Lb.*	*Lb.*	1,000 *Short Tons*	1,000 *Short Tons*
Winter rape	219.2	160.4	1,481.0	1,623.8	163.1	130.1
Spring rape	90.9	46.2	945.7	861.0	43.0	19.8
Turnip rape	67.7	61.3	811.9	861.0	26.5	26.5
White mustard	33.8	46.2	1,034.9	811.9	15.4	18.7
Flaxseed	58.1	50.6	901.1	869.9	27.6†	22.1‡
Total	469.7	364.7	1,168.8	1,191.1	275.6	217.2

*Indicated. †984,000 bushels. ‡787,000 bushels.

American Embassy, Stockholm.